U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 946

# Air Pollution Abstracts
## Volume 3, Number 4
## April 1972

Environmental Protection Agency, Research Triangle Park, N C

Apr 72

344027

PB 260 946

Volume 3, No. 4
April 1972
APABCA-3(4) (1972)

# AIR POLLUTION ABSTRACTS

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

**U.S. ENVIRONMENTAL PROTECTION AGENCY**
**Office of Air Programs**

# TECHNICAL REPORT DATA

*(Please read Instructions on the reverse before completing)*

**1. REPORT NO.**
APABCA-3-4-1972

**2.**

**3. RECIPIENT'S ACCESSION NO.**

**4. TITLE AND SUBTITLE**
Air Pollution Abstracts Volume 3, No. 4

**5. REPORT DATE**
April 1972

**6. PERFORMING ORGANIZATION CODE**

**7. AUTHOR(S)**

**8. PERFORMING ORGANIZATION REPORT NO.**

**9. PERFORMING ORGANIZATION NAME AND ADDRESS**
Air Pollution Technical Information Center
Research Triangle Park, North Carolina 27711

**10. PROGRAM ELEMENT NO.**

**11. CONTRACT/GRANT NO.**

**12. SPONSORING AGENCY NAME AND ADDRESS**
Same

**13. TYPE OF REPORT AND PERIOD COVERED**

**14. SPONSORING AGENCY CODE**

**15. SUPPLEMENTARY NOTES**

**16. ABSTRACT**

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 17906 - 18535.

**17. KEY WORDS AND DOCUMENT ANALYSIS**

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Air pollution |  | 13B |
| Abstracts |  | 5B |
| Information retrieval |  |  |

**18. DISTRIBUTION STATEMENT**
Unlimited

**19. SECURITY CLASS** *(This Report)*

**20. SECURITY CLASS** *(This page)*

**21. NO. OF PAGES**
158

**22. PRICE**
$6.75

EPA Form 2220-1 (9-73)

i

# AIR POLLUTION ABSTRACTS

Volume 3, No. 4 April 1972

**Prepared by:**

Air Pollution Technical Information Center (APTIC)
Research Triangle Park, North Carolina 27711

## CONTENTS

Introduction . . . . . . . . . . ii
Subject Fields and Scope Notes . . . . . . . . . . iii
Abstract Bulletin . . . . . . . . . . 1
Subject Index . . . . . . . . . . si-1

The terms that most closely describe the information presented in the documents are arranged alphabetically.

Author Index . . . . . . . . . . ai-1

Personal authors are arranged alphabetically. The names are presented last name first. The title of the document is indented below the author's name; when the author is the first author of a title, an asterisk precedes the Abstract Number on the next line.

**Use of funds for printing this publication approved by the Director, Bureau of the Budget, March 31, 1970**

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

i(a)

# INTRODUCTION

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given.

EPA's air pollution staff should direct requests for full text duplicates (if not locally available) to APTIC, using the order form provided. Translations of foreign language documents will be arranged upon request for these personnel only.

For non-EPA readers, APTIC can provide copies of only those articles that have been written by EPA's air pollution personnel and have not been published in the open literature. Requests for all other articles should be directed to local libraries, publishers, or authors, with the following exception. Copies of EPA's air pollution technical publications in the AP or APTD series, as indicated in the citation, will be provided, while supplies permit, only to certain qualified requesters, e.g., its current contractors, grantees, and air pollution control agencies; a list of these publications is available on request. When requesting any publications from APTIC, please include the complete citation.

Citations of documents available for purchase from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22151 are designated as NTIS; most are sold for three dollars in paper copy and ninety-five cents in microfiche. Registered users of the Defense Documentation Center (DDC) may obtain documents in the "AD" series for the same service charge from: Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. Citations of documents available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. are designated as GPO.

Translations are cited with their sources whenever possible. If a translation proves to be unavailable from the source cited, or if a translation is cited without a source, it may be located through APTIC or through the National Translations Center, 35 West 33rd Street, Chicago, Illinois 60616.

The serial publications (journals, periodicals, etc.) which are regularly screened for input are listed with their publishers' addresses in one issue in each volume of our abstract bulletin; the most recent list appeared in the December 1971 issue.

As another service, abstracts of all of the literature in APTIC (not just in a single issue of this periodical) on any subject related to air pollution will be provided free of charge upon request. APTIC can search information more recent than that in the current issue of this periodical because of lapse of time entailed by editorial, make-up, and printing work. More than 1400 subject index terms are available for such searching—more than those included in the subject index in each issue.

# SUBJECT FIELDS AND SCOPE NOTES

## 1. EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

## 2. CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry—e.g., automobiles.

## 3. MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development, testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

## 4. AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

## 5. ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere. Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions are assigned to Basic Science and Technology.

## 6. BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes photochemical studies in the atmosphere and biochemical studies related to effects of air pollution.

## 7. EFFECTS–HUMAN HEALTH

Covers medical and epedemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

## 8. EFFECTS–PLANTS AND LIVESTOCK

Effects on vegetation–crops, trees, other plants–and on livestock as distinguished from laboratory experimental animals.

## 9. EFFECTS–MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures.

## 10. ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

## 11. STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

## 12. LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractural activities and program descriptions.

## 13. SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes, public opinion studies, public relations, and public information.

## 14. GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories.

# ABSTRACT BULLETIN

## EMISSION SOURCES

17906 APTIC NO. 36123

Dept. of Commerce, Washington, D. C., Economic Development Administration

ENVIRONMENTAL IMPACT STATEMENT FOR HILLSDALE FOUNDRY COMPANY, HILLSDALE, MICHIGAN. (FINAL REPORT). *15p., May 20, 1971.*

NTIS: PB 199455F

The potential environmental impact of a proposed iron foundry in Hillsdale, Michigan is reported with comments and memos by the state public health department and concerned federal agencies. Environmental aspects under consideration included availability of transportation; waste disposal means; water supply; effect of noise, vibration, and noxious odors on wildlife; and foundry emissions. Smoke from the cupolas and dust and sand from the moulting area would be collected in a bag house. Captured solid material and slag from the melting process would be disposed of in a landfill. The foundry would rely on remoteness from inhabited areas and on the prevailing winds to carry stack emissions over sparsely inhabited areas. The particulate-free stack emissions may be slightly malodorous in the vicnity of the foundry but negligible at any distance.

17907 APTIC NO. 36136

Dept. of Interior, Washington, D. C., Office of Coal Research

DRAFT ENVIRONMENTAL STATEMENT RELATING TO LOCATION OF PROPOSED PILOT PLANT - FORT LEWIS, WASHINGTON (ON A USE PERMIT BASIS). *15p., April 30, 1971.*

NTIS: PB 198861-D

The potential environmental impact of a proposed pilot plant at Fort Lewis, Washington, for producing fluid or solid low sulfur fuel from coal by a solvation process is examined. Plant input and output, waste products, and alternatives to the plan are reviewed. Sanitary waste control methods and equipment include a caustic scrubbing system for gas streams, flaring, and dust collectors.

17908 APTIC NO. 36340

TIME-TEMPERATURE HISTORIES OF SPECIFIED FUEL SYSTEMS. VOLUME I. (FINAL REPORT). *Scott Research Labs., Inc., San Bernardino, Calif., Air Pollution Research Advisory Council Committee No. CAPE-5-68, Scott Proj. 2602, 285p., Oct. 15, 1969.*

NTIS: PB 200252

The time-temperature histories of various fuel system components were measured on 80 vehicles during a three-month period in the summer of 1968. Time-temperature effects the magnitude of fuel evaporation losses. A fuel system configuration survey was made and the test vehicles were selected to represent the maximum number of different fuel system configurations possible. The vehicles were instrumented to measure 16 fuel system temperatures and pressures. Measurements of fuel system time-temperature histories for both trip segments and soak periods were conducted. Multiple linear regression equations were developed to predict the effects of various independent variables on maximum fuel system temperatures during soak and driving segments. A pattern with several short trips during the day (including freeway and residential driving) causes higher fuel tank and carburetor maximum temperatures. To-and-from-work type patterns on the freeway cause higher maximum fuel tank and carburetor bowl temperatures than the business-residential routes. However, both of these type patterns caused lower maximum fuel system temperatures than the short trip patterns. On an overall pattern basis, ambient temperature is the dominant source of variance in fuel tank liquid temperatures, while vehicle-to-vehicle variance is the dominant source for carburetor fuel bowl temperature maxima. The data presented have value in the development of realistic laboratory test procedures for measuring fuel evaporative emissions. (Author summary modified)

17909 APTIC NO. 36435

DRAFT OF ENVIRONMENTAL STATEMENT, HUNTINGTON CANYON GENERATING STATION AND TRANSMISSION LINE. *77p., March 1971. 6 refs.*

NTIS: PB 198736

The potential impact on the environment of a proposed power generating and transmission station at Huntington Canyon, Utah is investigated with respect to sources of impact, environmental protection policy of the power company, environmental and meteorologic studies completed to date, control methods, alternatives to the proposed plant, and social attitudes. Data on winds, temperature, and humidity collected must be correlated with projected stack emission concentrations of carbon monoxide, water vapor, sulfur oxides, nitirogen oxides, and fly ash to determine effects of inversions and correlated data on air quality. Projected control methods include stacks of efficient height, electrostatic precipitators, wet scrubbers, use of low-sulfur coal, sulfur dioxide removal equipment, boilers utilizing tangential firing patterns, and water and noise pollution controls. Air quality requirements and emission criteria are discussed. Effects of emissions on human health, vegetation, and visibility are considered.

17910 APTIC NO. 36852

ROAD PLANING MACHINES. *Clean Air, 1(4):41-42, Winter 1971.*

Road-planing and road-heating machines developed by a British company utilize a luminous panel which does not provide flame contact with the road surface. Propane gas is used for fuel and, since there is no ignition of volatiles, no smoke pollution is created. The machines enable roads to be treated without contravening British Clean Air legislation.

17911 APTIC NO. 36874

Ibaragi Prefecture (Japan)

IBARAGI PREFECTURAL WHITE PAPER ON PUBLIC NUISANCE. *(Ibaragi-ken) Kogai hakusho). Text in Japanese. 210p., March 1971.*

Public nuisance due to air, water, noise, offensive odor, and industrial waste in Ibaragi prefecture were discussed. Countermeasures, monitoring, and administrative action are mentioned. The concentration of pollution around Hitachi was comparatively high but the pollution rate was not as serious compared with the whole country. In the Kashima area, the pollution rate by sulfur oxides was lower than in the Hitachi area, but the pollution rate in dust was higher because of the special topographical situation of sand dunes. Most of the complaints, however, against air pollution were not caused by the wide area pollution mentioned above, but by local pollution due to asphalt plants or various kinds of incinerators. Offensive odors caused by the hog raising industry throughout the whole prefecture and odors from dead animal processing plants were problems.

17912 APTIC NO. 37190

**ENVIRONMENTAL PROTECTION AND CULTIVATION OF THE ENVIRONMENT IN LOWER SAXONY.** *(Umweltschutz und Umweltpflege in Niedersachsen). Text in German. Staedtehygiene (Uelzen/Hamburg), 22(11):266-267, Nov. 1971.*

The emission limit values for sulfur dioxide and dust are exceeded in Lower Saxony during normal weather conditions only in individual critical areas. In the Nordenham area the soil and the vegetation are heavily enriched with lead and zinc dust, sulfur dioxide, and fluorine. The lead content of the soil has reached 120 times and zinc has reached 150 times the normal values. The milk of animals grazing in this area has to be heavily mixed with other milk in order to make it drinkable. In Delmhorst, the natural composition of the air is changed by the emissions of a linoleum plant and a lacquer-resin plant. During the oxidation of linseed oil and the melting of resins, acrolein, formic acid, acetic acid, and phenols are liberated. In Osterwald, the fluorine emissions of a ceramic plant has destroyed a large forest. Injuries in forests were also observed in Bad Salzdetfurth from the emissions of a potassium plant and near Munich by a cellulose plant. Animal mass breeding stations cause unbearable odor emissions in Suedoldenburg, Bersenbrueck, Diepholz, Bassum, and Nienburg.

17913 APTIC NO. 36802

Aaronson, Terri

**THE BLACK BOX.** *Environment, 13(10):10-18, Dec. 1971. 29 refs.*

A clean, safe means of generating electricity may result from the development of the fuel cell, a kind of black box which has virtually no moving parts, makes no noise, and generates only innocuous products and electricity. Although fuel cells theoretically approach 100% efficiency in converting chemical energy to electrical energy, the latest devices operate at 40% efficiency. Because of their greater efficiency, fuel cells require less fuel to generate an equal amount of electricity than conventional or nuclear power plants. Fuel cells are being developed for power station and vehicle use. The use of fuel cells in nonpolluting cars and vans, including hybrid fuel cell/battery vehicles is described. Two projects are currently testing the feasibility of fuel cells for generating electric power on a mass scale. One uses coal to power the cell and produces carbon dioxide and water as by-products. The second system runs on natural gas and produces carbon dioxide, water, and some heat as by-products. Because of the high efficiency, fuel cells are very economical. A coal-fired fuel-cell plant of one million kilowatt size would provide energy for only 0.299 cent per kilowatt-hour. Fuels for the cell can include hydrogen/oxygen, hydrogen/air, carbon monoxide/air, methane/air, and ammonia/air. The operation of direct and indirect fuel cells are discussed.

17914 APTIC NO. 36898

Ando, Hiroshi, Yoichi Mimura, Hidenori Tanaka, and Masuo Nishiyama

**GAS CHROMATOGRAPHY OF COMBUSTION PRODUCTS.** *(Gasukuro bunseki ni yoru genso hozon). Text in Japanese. Preprint, Science Council of Japan, Tokyo, 2p., 1971. 1 ref. (Presented at the Symposium on Combustion, 9th, Tokyo, Japan, Dec. 3-4, 1971.)*

A porous injection combustor with a clear quartz tube was used for burning pre-mixed propane-air mixtures; combustion conditions were observed through the quartz tube, and probe sampling was analyzed by gas chromatography. In order to measure the quantity of scarcely traceable amounts of hydrocarbons, a calculation method from the residual hydrocarbon was used. The first gas chromatography used helium as carrier, and analyzed oxygen, nitrogen, carbon monoxide, carbon dioxide, and hydrocarbons; nitrogen was used as the carrier for the second gas chromatography for analyzing hydrogen. When the phi (distance coefficient) was greater than one, CO increased at a faster rate than $H_2O$ and oxygen was theoretically insufficient, but 02 still existed; when it came closer to 1.4, a light increase of 02 was noted. The greater the phi after 1, the greater the residue of hydrocarbon. When phi was 1.15, most of residual hydrocarbon could be regarded close to methane composition. By calculating hydrocarbon from the amount of residue, combustion efficiency can be calculated and a good combustor can be designed.

17915 APTIC NO. 36127

Barton, R. K., S. S. Lestz, and W. E. Meyer

**AN EMPIRICAL MODEL FOR CORRELATING CYCLE-BY-CYCLE CYLINDER GAS MOTION AND COMBUSTION VARIATIONS OF A SPARK IGNITION ENGINE.** *Preprint, Society of Automotive Engineers, Inc., New York, 13p., 1971. 13 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710163.)*

The cycle-by-cycle (CBC) combustion variations of a spark-ignition engine were examined in terms of the CBC pressure development histories. A constant-temperature hot-film probe determined velocity variations from cycle to cycle of the motored engine in the vicinity of the spark plug at the crank angles at which ignition would take place under firing conditions. The standard deviations of the gas velocity near the spark plug were correlated to those of the crank angle at which maxiumu pressure occured for different operating variables. A correlation of 0.975 between the standard deviation of the velocity and the angle of occurrence of maximum pressure was determined by a model which assumed that the time required to burn the same initial volume of change each cycle was dependent only on this velocity. Results indicate that CBC combustion variations are caused by CBC variations of the gas velocity in the vicinity of the spark plug at the time of ignition. (Author abstract modified)

17916 APTIC NO. 36124

Bassemir, Robert W.

**AVOIDING SOLVENT EMISSIONS-SOLVENTLESS INKS.** *Preprint, American Inst. of Chemical Engineers, New York, [illegible]p., 1971. (Presented at the American Institute of Chemical Engineers National Meeting 70th, Atlantic City, N. J., Aug. 29-Sept. 1, 19771, Paper 48c.)*

The composition, costs, and efficiency of two types of solventless inks developed to reduce printing plant stack effluent caused by hydrocarbon solvent from ink, paper coating, ink mist, and thermal degradation of the resins in ink particles are examined. Thermal curing inks have very low vapor pressure at ambient temperatures0 and are extremely stable on the ink distribution rollers. A small amount of effluent is still liberated although there are no visible emission; condensable effluents are reduced by as much as 85%. Radiation curing inks emit no effluents from the polymerization process and are completely stable on the rollers. Pot life is virtually indefinite when kept from exposure to ultraviolet light and the paper is not degraded by high temperatures. Advantages, disadvantages, and costs of both ink types are compared.

17917 APTIC NO. 36082

Bell, A. G., J. A. Keene, and K. Reders

**ROAD ANTIKNOCK PERFORMANCE OF LOW LEAD AND NONLEADED GASOLINES IN EUROPEAN CARS.** *Preprint, Society of Automotive Engineers, Inc.,* *New York, 27p., 1971. 6 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710625.)*

An experiment designed to evaluate the road antiknock performance of low-lead and nonleaded gasolines is described. Over 100 test fuels covering a wide range of research octane number, lead content, sensitivity, and front-end quality were prepared. They were then tested in nine European and one American car under both accelerating and wide-open throttle constant-speed conditions. The design of the experiment and the analysis and interpretation of the results are described. In general, in European cars knocking at low speed, road antiknock performance can be adequately described in terms of research octane number, sensitivity, and front-end quality, and that there is no additional benefit to be gained from the use of a high concentration of lead. By contrast, in European cars knocking at high speed and in the one American car tested, gasolines with a high lead content gave a better performance than the equivalent nonleaded gasolines. This was particularly so in the case of fuels leaded with tetramethyl lead as opposed to tetraethyl lead. (Author abstract)

17918 APTIC NO. 36070

Biswas, B. K. and R. H. Essenhigh

THE PROBLEM OF SMOKE FORMATION AND CONTROL. *Preprint, American Inst. of Chemical Engineers, New York, 27p., 1971. 26 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 70th, Atlantic City, N. J., Aug. 29-Sept. 1, 1971, Paper 39f.)*

Prevention of fossil fuel smoke emissions by combustions was investigated using a stirred combustor designed to reduce or eliminate problems from slow mixing. The theory, experimental conditions, and results of test on smoke formation are described. Rapidity of mixing, kinetic constants, stability, and reactor extinction limits were determined. Operational equations to predict smoke combustion are discussed.

17919 APTIC NO. 36277

Brooks, R. R.

TRENDS IN REFUSE-FIRED BOILER DESIGN. *Modern Power Eng., 65(12): 28-30, Dec. 1971.*

Three significant factors are affecting the design of today s refuse burning boilers: size of the boilers is growing to accommodate increasing volumes of refuse; supplementary fuel firing patterns are changing, with increasing use of combination firing; and restrictive air pollution requirements are posing new challenges as boiler designers continue their drive to minimize particulate matter leaving the unit. Units fired by pneumatic spreaders with water-cooled flat grates, with continuous ash- discharge grates, and inclined water-cooled grates are described. Dust collection equipment, overfire air, and cinder recovery systems are indicated to ensure maximum burnout of the wood refuse and the control of emissions.

17920 APTIC NO. 36089

Brown, D. H.

HYBRID BATTERY SYSTEM. *Preprint, Society of Automotive Engineers, Inc., New York, 3p., 1971. 2 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710236.)*

Electric vehicles must provide bursts of high torque as they accelerate from standstill to operating speed. Lead-acid batteries exhibit substantial reduction ampere-hour capacity as the result of high current demand for acceleration and hill climbing. Nickel-cadmium batteries have better ampere-hour rating than lead-acid batteries, but their costs are substantially greater. An economical hybrid system utilizes a small nickel-cadmium battery for acceleration and a variable connection to isolate the main lead-acid battery from brief peak current demands. The resulting performance offers the advantages of reduced main battery weight, extended range, and responsiveness to acceleration demands.

17921 APTIC NO. 36099

Cherry, William R.

THE GENERATION OF POLLUTION FREE ELECTRICAL POWER FROM SOLAR ENERGY. *National Aeronautics and Space Administration, Greenbelt, Md., Goddard Space Flight Center, TM-X-760-71-135, 14p., March 1971. 9 refs.*

NTIS: N71-23700

Appraisal of a pollution-free method of converting solar energy directly into electric power using photovoltaics (solar cells) shows that sunlight falling on about one percent of the land area of the 48 states could provide the total electric power requirements of the U.S. in 1990 with use and further development of space technology. While the cost of producing solar arrays by present methods prohibits their use for large-scale terrestrial plants, methods are suggested for reducing costs to acceptable levels (especially as conventional fuels become more scarce and expensive), for example, by relaxing stringent space cosmetic and performance specifications, using simple concentrators, changing the shape of the cells, and using inherently inexpensive processes such as evaporation or deposition on long sheets of substrate. A solar energy power supply would have numerous conservation, social, ecologic, economic, and political standpoints. (Author abstract modified)

17922 APTIC NO. 36348

Chilcote, David O.

STRAW UTILIZATION RESEARCH. *In: Research Relating to Agricultural Field Burning. A Progress Report. Oregon State Univ., Corvallis, Agricultural Experiment Station and Oregon State Univ., Corvallis, Air Resources Center, p. 9-11, Feb, 1971. 7 refs.*

Research to determine the technological and economical feasibility of straw as raw material for industrial uses and animal feed is reviewed. Problems in developing markets for straw products involve supply, densification, handling, and storage. Possible uses for straw include pulp and paper manufacture, animal feed rations, structural uses (fiberboard), manufacture, animal feed rations, structural uses (fiberboard), microbial protein production, and fuel uses.

17923 APTIC NO. 36080

Crouse, W. W., R. H. Johnson, and W. H. Reiland

EFFECT OF UNLEADED FUEL ON LUBRICANT PERFORMANCE. *Preprint, Society of Automotive Engineers, Inc., New York, 6p., 1971. 1 ref. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710584.)*

The performance of motor oils in engines run on unleaded fuels was evaluated using several makes of United States cars. These oils were run in high mileage or turnpike service, as well as suburban service. The performance with unleaded fuels was not significantly different from that for leaded fuels in the areas of wear, sludge, varnish, or rust. Valve seat recession was detected in several of the cars, but had an effect on performance in only one case. Further testing using laboratory engines and a patrol fleet in pursuit service demonstrated the effect of lubricant composition on valve seat recession. In addition, engines preconditioned on leaded fuels afforded better protection against valve seat recession than new engines. (Author abstract modified)

17924 APTIC NO. 36045

Dams R., R. Heindryckx, and K. van Cauwenberghe

CHEMISTRY AND DETERMINATION OF AIR POLLUTANTS. *(Scheikunde en analyse van luchtpollutie). Text in Dutch. Ind. Chim. Belge, 36(7):589-626, 1971. 231 refs.*

Gaseous pollutants include sulfur compounds, hydrocarbons, nitrogen compounds, ozone, fluoride compounds and chlorine compounds. Sampling methods are explained. The term Residence Time is defined. Sources of sulfur containing gases are tabulated, and chemical reactions of sulfur dioxide formation are given. Methods of analysis of sulfur dioxide are described. Biological and toxicological effects of hydrogen sulfide are described. The sources, measurement, formation, and possible effects of carbon dioxide, fluorine and chlorine compounds, carbon monoxide, and nitrogen oxides are discussed. The natural cycle of ozone in atmosphere and polluting effects of ozone are described. The phenomenon of photochemical mist formation in London and Los Angeles is described. Also mentioned are: Reduction of visibility through smoke, aerosols and photochemical generation of mists; effects on materials; effects on agricultural products through sulfur dioxide, fluorides, or ozone; and physiological and psychological effects.

17925 APTIC NO. 36053

Dimitriades, B. and H. B. Carroll, Jr.

PHOTOCHEMICAL REACTIVITY OF DIESEL EXHAUST. SOME PRELIMINARY TESTS. *Bureau of Mines, Washington, D. C., RI-7514, 6p., 1971. 5 refs.*

Photochemical reactivities of diesel exhaust, gasoline exhaust, and propylene were measured in a smog chamber at temperatures of 92 and 203 F. Irradiation was provided by one fluorescent lamp mounted along the cylindrical chamber axis. Light intensity measured by the nitrogen dioxide photolysis method represented sunlight intensity on a typical sunny day in Bartlesville, Okla. Reactivity was measured and expressed in terms of rate of NO2 formation. Preliminary tests indicated that high temperature of chamber walls favors stability of diesel-exhaust hydrocarbons but also promotes disappearance on NO2, mostly through dissociation into nitric oxide. At optimum wall temperature, judged to be 200 F, the rate of hydrocarbon loss from diesel exhaust at 5 ppm C was 0.15 ppm C/hr; the rate of NO2 loss at 1.3 ppm was 0.2 ppm/hr. The instability of some diesel-exhaust hydrocarbons seriously hinders the measurement of photochemical reactivity diesel-exhaust mixtures as discharged from the engine. Results suggests that the rate of NO2 formation reactivity of diesel-exhaust hydrocarbons that are relatively stable in the gaseous phase is roughly comparable to that of gasoline-exhaust hydrocarbons. The heavier, more unstable components probably deposit rapidly on the surface of suspended particulates, with possible adverse effects on visibility.

17926 APTIC NO. 36242

Fraize, W. E. and R. K. Lay

A SURVEY OF PROPULSION SYSTEMS FOR LOW EMISSION URBAN VEHICLES. (FINAL REPORT). *MITRE Corp., McClean, Va., Transporation Systems Engineering Dept, Dept of Transportation Contract AF 19628-68-C-0365, Rept. UMTA-TRD-52-70-2, MITRE Rept. M70-45, 120p., Sept. 1970. 107 refs.*

NTIS: PB 200144

The state of the art of low-emission propulsion systems for buses was surveyed. Survey findings indicate little incentive for fleet vehicles to use emission control devices such as manifold reactors, catalytic mufflers, and exhaust gas recirculation systems. These approaches are costly and do not meet the 1974 California standards over extended periods of time. A natural gas-fueled internal combustion engine is available today for low-cost conversion of fleet vehicles. It will meet the 1974 California standards. Given the present level of battery storage capability, the electric bus will not provide the necessary performance and range for general application; it might, however, have operating and maintenance advantages for high-density city-center routes with frequent stops. The gas turbine is a near-term solution for long-range, fossil-fuel vehicles with emphasis on cruise operation, while the Rankine steam engine is a long-term solution for fossil-fueled vehicles with emphasis on stop-and-go operation. Hybrid drive trains offer a potential long-term solution for vehicles requiring the long range of fossil-fueled systems, flexibility of emissions, and stop-and-go driving. Associated with each of these alternatives is a wide range of drive-train components. To integrate the various components into a complete propulsion unit meeting a particular vehicle mission requires a methodology for system selection. A nucleus for this methodology is a computer program developed to demonstrate the effect of vehicle and route parameters on required power and vehicle speed.

17927 APTIC NO. 36364

Gaskill, James R.

SMOKE DEVELOPMENT IN POLYMERS DURING PYROLYSIS OR COMBUSTION. *J. Fire Flammability, vol. 1:183-216, July 1970. 16 refs. (Presented at the 1970 Polymer Conference Series, University of Utah, Salt Lake City.*

A modification of the National Bureau of Standards Smoke Chamber was used to evaluate the smoke opacity developed by a number of woods, plastics, coatings, and combination, under conditions of pyrolysis or combustion, both with and without ventilation. Woods and most plastics pyrolyze to yield dense smokes. Woods burn cleanly, yielding lighter smokes. Most plastics, especially those containing fire retardants, quickly produce dense smokes when burned. High ventilation rates help clear away pyrolysis smokes, but are relatively ineffective on the heavy smokes from burning fire-retardant plastics. A Materials Smoke Obscuration Index is proposed, using existing data and those to be obtained employing higher heat rates under the conditions outlined above. (Author abstract modified)

17928 APTIC NO. 36359

Gilbert, J. A. S. and A. J. Lindsey

POLYCYCLIC HYDROCARBONS IN TOBACCO SMOKE: PIPE SMOKING EXPERIMENTS. *Brit. J. Cancer (London), vol. 10:646-648, 1956. 6 refs.*

Pipe tobaccos and herbal smoking mixtures, smoked mechanically in a machine simulating human pipe smoking, produce condensates containing much higher proportions of polycyclic aromatic hydrocarbons than were obtained from cigarette smoke. The following compounds were detected and determined: acenaphthylene, anthanthrene, anthracene, azulene, 1,2-benzanthracene, 3,4-benzpyrene, coronene, fluoranthene, fluorene, 3-methylpyrene, naphthalene, phenanthrene, and pyrene. Extraction of the dried tobaccos with cyclohexane showed that the hydrocarbons are present in small amounts before smoking. (Author summary modified)

17929 APTIC NO. 36481

Gruemm, H.

ENERGY GENERTION AND THE ENVIRONMENT. *(Energieerzeugung und Umwelt). Text in German. Preprint, 52p., 1971. 38 refs. (Presented at the Reactor Conference of the German Atom Forum, Bonn, West Germany, March 31, 1971.)*

Many people, even experts, are opposed to nuclear energy on the grounds that it involves great danger to environment. Other forms of energy generation and their respective effects on environment should be investigated. Power requirements and present means to meet them, and combustion processes with their effects on environment are discussed. Energy production based on combustion processes has already caused measurable changes in the environment. Air pollution and discharge heat from thermal power plants are discussed. In a comparison of the harmful effects on environment of fossil-fuel and nuclear power plants, the latter prove to be far superior. With radiation loads far below the natural level, in normal operation, actual effects could be reduced to the discharge of heat. Global and long-term effects of nuclear power plants originate chiefly in nuclear wastes (tritium and krypton 85), but adequate solutions are being developed. Very high potential dangers required rigorous regulations and measures for nuclear power plants from the very beginning. Examples showing accidents and radiation exposures at nuclear plants testify that they contribute very little to permanent risks in densely populated areas. Thus, atomic energy was discovered in time both to help meet increasing energy requirements, in view of the restrictedness of energy resources, to control air pollution, and to lessen the effects on environment of fossil-fuel power plants and other industries. Environmental protection and energy production are issues that require complex international cooperation in research and development.

17930 APTIC NO. 36392

Hendrickson, E. R. and C. I. Harding

AIR POLLUTION PROBLEMS ASSOCIATION WITH KRAFT PULPING. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr., Proc., London, England, 1966, p. 95-97. 15 refs. (Oct. 4-7, Paper IV/6.)*

Kraft pulping as an emission source is reviewed with respect to processes involved, defined sources, pollutants, and control methods. The main potential air contaminants from the pulping process are particulates (sodium carbonate, sodium sulfate, carbon, and calcium oxide) and odorous gases, including sulfur dioxide, hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. The pollutants contribute to corrosion of materials and may be harmful to vegetation.

17931 APTIC NO. 36128

Herbert, G. F. and A. E. Anderson

POWER REQUIREMENTS OF ELECTRIC VEHICLES. *Preprint, Society of Automotive Engineers, Inc., New York, 19p., 1971. 12 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710238.)*

An analytical investigation has provided a new and useful procedure for evaluating the peak power requirements of a vehicle, based upon the desired velels of accelerative performance and the vehicle usage, that is, city, suburban, or highway applications. These power requirements have been used to determine the required weight of the vehicle power source, based upon its effective power density and the propulsion system efficiency. A computer solution to the one-dimensional equation of motion of a vehicle with a non-linear input was used to predict vehicle performance. Consideration has been given to various combinations of constant power-torque limited drives to determine the relationship between the torque-speed characteristics of the energy source and the vehicle performance. This information was used to find the locus of power which the energy source must deliver to provide the desired vehicle performance within specified limits. To illustrate potential applications of this method, examples of a battery-electric drive and a hybrid drive system were considered for a compact-size car with performance equivalent to today s compacts. Three types of batteries were used to demonstrate that the vehicle performance is severely degraded as the battery becomes discharged. Battery discharge derating factors, which were developed to characterize this behavior, can be applied to the rated power densities to determine the effective power density of a given battery at any predetermined maximum depth of discharge. It was found that the battery weight penalty was high when a vehicle was designed to provide minimum acceptable performance at a preselected state of battery discharge. (Author abstract)

17932 APTIC NO. 36451

Hietbrink, E. H. and S. B. Tricklebank

ELECTRIC STORAGE BATTERIES FOR VEHICLE PROPULSION. *Preprint, American Society of Mechanical Engineers, New York, 9p., 1970. 15 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, New York, Nov. 29-Dec. 3, 1970, Paper 70-WA/Ener-7.)*

An attempt is made to summarize the power and energy requirements of a battery power plant for specific vehicular applications and to probe, in some detail, the development problems associated with those advanced battery concepts that theoretically have the capability of meeting there requirements. Of the several batteries listed, only the lead-acid type could be considered as a fully developed battery. Secondary nickel-zinc batteries have recently been marketed, but their energy density is still rather low. Problems are due to inefficiencies during charge of the nickel electrode, which means that the zinc electrode must be overcharged. While the zinc-air system has a relatively high energy density, this density is achieved by using relatively thick anodes. High-temperature, molten salt electrolytes have been receiving attention as possible high energy density, high power density batteries. Lithium-chlorine, lithium-sulfur, and sodium-sulfur systems are discussed. Fuel cells and propylene carbonate systems are also mentioned.

17933 APTIC NO. 36290

Honda, T., K. Nishida, T. Suzuka, and K. Mitsuoka

THE ESTIMATION OF AUTOMOBILE EXHAUST EMISSIONS IN OSAKA. *(Osakashi-iki ni okeru jidosha haiki gasu no hoshutsuryo no santei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):237, 1971. (Presented at the National Council Meeting of air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

From the actual vehicle distribution on main roads (width greater than six m) in Osaka City counted from an air photo taken between 2:00 and 3:00 pm on April 15, 1970, and the emission coefficient of carbon monoxide and hydrocarbons determined based on the traffic volume, road characteristics, and driving patterns, the total amounts of CO and hydrocarbon emission were estimated: CO, 30.64 t/hr; hydrocarbons, 14.76 t/hr.

17934 APTIC NO. 36381

Horn, K. and A. Knauer

THE AIR HYGIENE PROBLEM IN THE GERMAN DEMOCRATIC REPUBLIC. *(Lufthygienische Probleme in die DDR). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 57-60. 17 refs. (Oct. 4-7, Paper III/7.)*

The problem of air pollution is reviewed for East Germany. As a result of increasing industrialization, the gaseous content of the atmosphere has increased. The industrial production index rose from 100 in 1950 to 368 in 1964. The major pollutants are dust and sulfur-containing gases due to the combustion of brown coal for electric power production; domestic heating also contributes to emissions. Automotive emissions are of secondary importance. Results of air pollution measurements, effects on the environment, and problems of air pollution control are discussed.

17935 APTIC NO. 37204

Ikeda, K. and K. Hishida

STUDIES OF VEHICLE EXHAUST INTENSITY. *(Jidosha haishutsu gasu no haishutsu kyodo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):232, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The total volume of auto exhaust emitted in Tokyo City at present was estimated at .751 at intersections and the roads connecting them. The total volume of auto emissions was based on the traffic volume by classifying auto types into three categories, diesel engines, passenger cars, and light motor vehicles. The driving pattern was assumed to be 30 yields 20 yields 30 km/hr. The carbon monoxide estimation model was devised. The total CO volume emitted per day was obtained from the total driving distance (distance between two intersections times number of vehicles) and the connection coefficient 1.38.

**17936** **APTIC NO. 36381**

Isaac, P. C. G.

CONTINENTAL REPORT: AFRICA. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr., Proc. London, England, 1966, p. 13-14. 3 refs. (Oct. 4-7, Paper II/1.)*

The air pollution problem in Africa is reviewed. Ill-effects of air pollution are more widespread than expected due mainly to extensive smoking habits. The sources of pollution, natural and industrial, include desert dust; automobiles and other vehicles; bush burning; domestic smoke from cooking fires; winter heating with wood, charcoal, and cow dung; crude incineration of waste; expanding industries, i.e., cement plants, oil refining, rubber processing, quarries, asbestos, and earthenware; and railway locomotives. The effects of climate on air pollution are reviewed with respect to temperature inversions, topographic interactions, and fogs. Control legislation is discussed.

**17937** **APTIC NO. 36846**

Khan, I. M.

FORMATION AND COMBUSTION OF CARBON IN A DIESEL ENGINE. *Lucas Eng. Rev., 5(2):42-47, Nov. 1971. 6 refs. (Presented at the Institution of Mechanical Engineers, Diesel Engine Combustion Symposium, London, England, April 1970.)*

An investigation was undertaken to determine the mechanisms of smoke formation and smoke consumption in a diesel engine cylinder. By suitable modification of the engine, only one of the four cylinders of four liter engine was used for the experiments. Experiments were carried out at engine speeds of 1100, 2000, and 2700 rev/min, using two different injection rates at each speed. Different shapes of injection diagrams of the same average rate, that is, the same total period, were also used at 1100 and 2000 rev/min. The exhaust smoke level is primarily determined by carbon concentration (net soot release) at the end of heat release, particularly at high engine speeds. For a given type of fuel, the major factors affecting net soot release are amount and rate of diffusion burning, flame temperature, and extent of recirculation of carbon in flame. While an increase in the amount of fuel burning increases the net soot release, an increase in the rate of burning has the opposite effect. With an increase in diffusion flame temperature, the increase in carbon formation far outweighs any increase in the rate of carbon combustion during the cycle. These factors are controlled by varying injection timing, rate of injection, and number and diameter of nozzle holes. Combustion of net soot release is determined by the gas temperature prevailing at the end of heat release, the time during which it remains high enough to give an appreciable rate of carbon combustion, and the oxygen available. (Author conclusions modified)

**17938** **APTIC NO. 36274**

Kitaoka, Yoji and Katsuhide Murata

EXPERIMENTS ON THE THERMAL DEGRADATION OF ETHYLENE LOW POLYMER. *(Poriechiren roporima no netsu bunkai jikken). Text in Japanese. Nenryo Kyokaishi (J. Japan Fuel Soc., Tokyo), 50(534):791-799, Oct. 1971. 10 refs.*

Using a continuous flow stirred tank reactor, a series of experiments were carried out on the thermal degradation of low ethylene polymer. The temperature of the thermal degradation, degradation rate, composition of the products, and carbon formation on the heated surface were determined. The degradation product was separated into two parts, a volatile gas and the other a non volatile oily product, in the ratio of about one to 24. The volatile gas was composed of methane, ethylene, ethane, propene, propane, butene, and butane. The nonvolatile component was composed of C5 to C30 hydrocarbons, which contained n-paraffins, 1-olefins, and isomers in the ratio of about six to three to one. A degradation rate of 7.0 g/cu cm per hr at 440 C, and an activation energy of 48.6 kcal/mol, were found. Carbon deposition on the heated surface was prevented by vigorous agitation.

**17939** **APTIC NO. 37166**

Kiyoura, Raisaku

ENERGY AND POLLUTION – DEVELOPMENT OF POLLUTION-FREE FUEL. *Chem. Economy Eng. Rev., 3(11):25-32, Nov. 1971.*

Data are presented on energy consumption in major countries, emission of air pollutants in major countries, nationwide emissions in the U. S., sulfur dioxide concentrations in major industrial nations, and sources of carbon monoxide, sulfur oxide, and particulate emissions. The decrease in the pH value of precipitation in Europe and the parallel increase in the sulfuric acid content is discussed, as is the worldwide increase in lead pollution. Major requirements of the U. S. Clean Air Act are summarized and major flue-gas desulfurization processes are outlined. Japan, with its severe environmental standards for sulfur oxides, is making extensive efforts to produce sulfur-free fuel. Numerous heavy-oil desulfurization plants are in existence, and the average sulfur content of imported crude has been reduced to 1.5%. In oil refining, the investments in desulfurization facilities represent 14.7% of the investments in total equipment.

**17940** **APTIC NO. 36044**

Kooij, J. van der and A. I. Elshout

THE EMISSION OF NITROGEN OXIDES. *(De emmissie van stikstofoxyden). Text in Dutch. Electrotech., 49e(23):1067-1073, Nov. 11, 1971. 14 refs.*

The problem of nitrogen oxide emissions from electric power production is reviewed. In 1970, electric power production accounted for less than 20% of the nitrogen oxide produced from all sources. Chemical reactions of nitric oxide formation are discussed in detail. The formation of nitrogen oxides in furnaces and boilers is described. Exhaust gas quantity, nitrogen content of oils, and load influence the quantity of nitrogen oxide emissions. The influence of natural gas firing is discussed. Limiting excess air, reducing flame temperature, improving temperature distribution of the furnace, and reducing residence time of the flue gases can reduce NOx emissions. To achieve the reduction of maximum flame temperature following methods are suggested: use of a larger heat transfer surface in the combustion space, two stage combustion, off-stoichiometric combustion, and recirculation of a portion of the gas. These methods are discussed and explained in detail.

**17941** **APTIC NO. 36505**

Kubota, K., Mitsuo Iida, T. Oodaira, and T. Saito

ANALYSIS OF DRIVING PATTERN IN TOKYO. *(Tonai no jidosha soko jotai no chosa kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):236, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The mode of driving in Tokyo was surveyed by driving testing cars equipped with instruments for recording driving speed, rotary speed of engine, and degree of throttle opening in February, 1969 and 1970. The ratio of four driving cycles, idle, acceleration, cruise, and deceleration, varied from year to year. From the ratio of driving cycles, time ratio, and frequency, a typical pattern of Tokyo traffic was drawn by plotting speed versus time.

*17942* *APTIC NO. 36423*

*Laamanen, A. and L. Noro*

*THE AIR POLLUTION SITUATION AND SPECIAL PROBLEMS IN FINLAND. International Union of Air Pollution Prevention Associations., Intern. Clean Air Congr. Proc., London, England, 1966, p. 77-79. 13 refs. (Oct. 4-7, Paper III/13.)*

The problem of air pollution in Finland is reviewed with respect to pollution investigations, organization, and legislation. Regional investigations in urban and rural areas established that the increased number of registered vehicles, growing industrial activity, and population density have affected atmospheric concentrations of pollutants. The effects were minimized by meteorological and source factors and special local factors, including automotive emission controls, traffic control, and domestic heating modifications.

17943 APTIC NO. 36535

Lafferty, W. L., Jr. and R. W. Stokeld

ALKYLATIN AND ISOMERIZATION. *Advan. Chem. Ser., no. 103:130-149, 1971. 45 refs.*

Alkylation processes for the production of highly branched paraffins for use in high octane gasoline have attained exceptional importance in the petroleum industry over the past 30 years. The rapid growth of alkylation created large demands for isobutane, and to help supply these demands, butane isomerization processes were developed. Subsequently, isomerization technology was applied to higher molecular weight paraffins, and various isomerization processes were developed to complement alkylation as a tool for gasoline manufacture. If the demand for gasoline continues to increase at the present rate, 40,000-60,000 BPD of new alkylation capacity will be added annually in the years ahead. Gradual reduction or total elimination of lead antiknock compounds will result in even higher annual growth rates of alkylation, and in additional isomerization capacity. Legislation on the volatility, olefin content, or aromatic content of gasoline could also accelerate the growth of alkylation and isomerization.

17944 APTIC NO. 36135

Lambert, Joseph R.

ENVIRONMENTAL STATEMENT. HILL AIR FORCE BASE, UTAH. *Air Force Logistic Command Washington, D. C., 43p., April 7, 1971.*

NTIS: PB 198764

The potential environmental impact of a helicopter training site at Hill Air Force Base, Utah, on the surrounding area is examined with respect to effects on air and water quality, noise control, land use, effects on fish and wildlife, unavoidable adverse effects, and alternatives. The mission would increase daily average traffic by 30%, resulting in a 160% increase in total base fuel consumption and a 3% overall increase in total area consumption. Smoke generated by open burning of jet fuel would be dissipated within five to ten minutes, depending upon wind velocities at high altitudes. Maintenance operations and utility support for the project would be controlled to prevent emissions from exceeding established standards. The only unavoidable adverse effect, therefore, would be from aircraft firefighting training, which results in smoke and unburned jet fuel; these would be minimized by strict controls and the installation of smoke suppression devices.

17945 APTIC NO. 36221

Lansche, Arnold M.

SULFUR AND PYRITES. *In: Bureau of Mines Minerals Yearbook. Washington, D. C., Government Printing Office, 1969, 11p. 20 refs.*

The present status of sulfur and pyrites production, consumption, prices, and foreign trade is reviewed. Annual data are given for domestic and foreign production and consumption, including elemental sulfur and by-product sulfuric acid recovered during production. World production of elemental sulfur reached 19.8 million tons in 1969, a five percent increase over the total for the previous year. Removal or control of sulfur dioxide emissions from smelters, power plants, boilers, and flue gases is examined. Control processes and equipment included scrubbers to absorb the SO2 from the stack gas; catalytic oxidation; dry limestone additives; removal of SO2 by catalytic oxidation, followed by removal of fly ash by mechanical separator and electrostatic precipitator. The basic characteristics of fuel desulfurization are discussed.

17946 APTIC NO. 36116

Liimatta, D. R., R. F. Hurt, R. W. Deller, and W. L. Hull

EFFECTS OF MIXTURE DISTRIBUTION ON EXHAUST EMISSIONS AS INDICATED BY ENGINE DATA AND THE HYDRAULIC ANALOGY. *Preprint, Society of Automotive Engineers, Inc., New York, 32p., 1971. 13 refs. (Presented at the Society of Automotive Engineers Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710618.)*

The effect of the distribution of inducted fuel on major automotive exhaust pollutants and the mixing conditions occurring in the induction system were investigated. Uniform fuel distribution among the cylinders of the engine permitted lean air-fuel mixtures to be used, resulting in low emissions of hydrocarbons, carbon monoxide, and nitrogen oxides. Lower concentrations of CO and higher NOx emissions were most pronounced at near stoichiometric mixture fuel-air ratios. The hydraulic analogy and geometric configurations on a water table were used to study the mixing phenomena. Slight geometric alterations were developed that considerably altered the mixing conditions. The momenta of the jets used with the addition of deflectors effectively aided in fuel droplet breakup. A vortex generator increased the mixing length, shear, and turbulent intensity of the flow field. Examples of the utility of the water table mixing pattern photographs are presented for actual induction systems. (Author conclusions modified)

17947 APTIC NO. 36126

Martin, G. Blair and E. E. Berkau

AN INVESTIGATION OF THE CONVERSION OF VARIOUS FUEL NITROGEN COMPOUNDS TO NITROGEN OXIDES IN OIL COMBUSTION. *Preprint, American Inst. of Chemical Engineers, New York, 43p., 1971. 20 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 70th, Atlantic City, N. J., Aug. 29-Sept. 1, 1971, Paper 37f.)*

A distillate oil fired laboratory furnace was used to determine the contritution of fuel nitrogen to total nitrogen oxides emissions from combustion sources. Results indicate that atmospheric fixation and fuel nitrogen conversion are independent and additive mechanisms for the formation of NOx. Fuel nitrogen conversion produced 2-15 times the NO produced by thermal fixation. The most common fuels containing nitrogen compounds (pyridine, piperidine, and quinoline) are heavy oil and coal. The fraction of fuel nitrogen converted ranging, from 0.02 to 0.07, increases with stoichiometric ratio and decreases with fuel nitrogen concentration. However, the absolute NO concentration in the flue gas increase with both stoichiometric ratio and nitrogen concentration. The conversion to NO less dependent on nitrogen compound than on any other factor. Reaction rates are defined for fuel nitrogen conversion. Based on the theory presented, the chemistry of conversion to NO will be much less temperature sensitive than the production of NO by fixation. Therefore, two-stage combustion appears a likely control strategy for control of fuel NO, while, the utility of flue gas recirculation will probably be limited. (Author conclusions modified)

17948 APTIC NO. 36232

Masterov, A. P.

METHODS FOR REDUCTION OF THE AMOUNT OF TOXIC GASEOUS EFFLUENTS DISCHARGED INTO THE ATMOSPHERE AND PURIFICATION OF SEWAGE WATERS IN THE PRODUCTION OF METHANOL. *(Puti umensheniya vybrosov vrednykh gazov v atmosferu i obezvrezhivaniye stochnykh vod v proizvodstve metanola). Text in Russian. Khim. Prom. Ukr. (Ukr. Ed.), 41(3):55-57, 1970.*

Gaseous emissions from the production of methanol are discussed and maximum permissible concentrations for some of these toxic substances are reported. An example of the determination of concentrations near ground level and at a distance from the pollution source is given. Quantitative data are presented on purification of sewage waters in methanol production by biologic oxidation in air tanks with activated sludge.

17949 APTIC NO. 36113

Matsuoka, Shin, Takehisa Yamaguchi, and Yukio Umemura

FACTORS INFLUENCING THE CYCLIC VARIATION OF COMBUSTION OF SPARK IGNITION ENGINE. *Preprint, Society of Automotive Engineers, Inc., New York, 24p., 1971. 24 refs. (Presented at the Society of Automotive Engineers Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710586.)*

A statistical measurement of cyclic variation in combustion of a spark ignition engine generated by changes of mixture conditions in the cylinder was compared with the actual measurement of variation of flow velocity and mixture ratio. Correlations of combustion speed, flow velocity, and mixture ratio were determined indicated that combustion variation increases with an increase of the combustion period. Cyclic variation caused by the variation of mean flow velocity in the cylinder is discussed. Measurement of the curve of standard deviation of the maximum rate of change of pressure indicated whether the mixture ratio or velocity variations were causing cyclic fluctuations. The time of maximum pressure accuartely determined the trend of mean combustion time. (Author abstract modified)

17950 APTIC NO. 36404

Meenaghan, G. F., D. M. Wells, R. C. Albin, and W. Grub

GAS PRODUCTION FROM BEEF CATTLE WASTES. *Preprint, American Society of Agricultural Engineers, St. Joseph, Mich., 15p., 1970. (Presented at the American Society of Agricultural Engineers, Winter Meeting, Chicago, Ill., Dec. 8-11, 1970, Paper 70-907.)*

A two-stage completely mixed isothermal digestion system for the anerobic disposal of cattle waste having a capacity of 30 gallons/stage was fed wastes from a beef cattle controlled environment chamber. Gas production was monitored and analyzed for methane and carbon dioxide by a wet test meter and a gas chromatograph. Then physical, chemical, and biochemical tests were also performed. The average daily cu ft of gas/cu ft of capacity in Stage one was slightly more than two times that for Stage two, namely 4.3 cu ft/cu ft versus 2.82 cu ft/cu ft, respectively. The methane concentration in Stage two was greater than for Stage one, namely 72% versus 53%, respectively. The over all digestion process produced 5.7 cu ft methane/animal/day, measured at standard conditions. A completely mixed, two stage anaerobic digestion system is technically feasible and can be used for obtaining nominal treatment of beef cattle wastes. Even with optimal conditions per stage, such a system would not be sufficient for complete treatment.

17951 APTIC NO. 36049

Mezieres, F. A.

ACCOMPLISHMENTS OF THE SWEDISH PAPER INDUSTRY IN MATTERS OF ENVIRONMENTAL PROTECTION. *(Quelques realisations fe l industrie papetiere suedoise en matiere de protection de l environment). Text in French. Papeterie, 92(12):1199-1200, 1202, 1205-1208, 1211, Dec. 1970.*

The Swedish pulp, paper, and fiber sheet industry produces 90% of all biochemical waste, half of it derived from the manufacture of bisulfite pulp. It used to discharge 600,000 tons of lignin into the rivers/year and 200,000 tons of sulfur dioxide into the air, equivalent to 20% of such emissions in the whole of Sweden. An important pollutant from the paper industry is mercury which is employed for producing chlorine and caustic soda, using electrolytic mercury cells. Improved arrangements have made it possible to drastically reduce the amounts of mercury in the effluents. The latest status is that, in view of the new Swedish antipollution regulations, techniques have been developed which completely eliminate the use of mercury. Other important developments are taking place with regard to residual liquors which used to be a major source of river pollution. The new installations employ a soluble base of soda or magnesium, and evaporate the residual liquor, thus largely avoiding the discharge into rivers and causing instead, as the lesser evil, increased pollution of air. Several other newly developed processes are discussed for treatment of the residual liquors obtained in the processes of boiling and bleaching. The reuse of waste fibers apparently represents one of the more difficult problems.

17952 APTIC NO. 36480

Mezieres, F. A.

SCANDINAVIAN PAPER-MAKING INDUSTRY AND ENVIRONMENTAL PROTECTION. *(L industrie papetiere nordique et la protection de l environnement.) Text in French. Papeterie, 93(11):1051-1055, Nov. 1971. 1 ref.*

Data showing the increase in the production of the paper-making industries of the Scandinavian countries (Finland, Sweden, Norway) are presented for the period 1953-1969. The paper-making industries in the above countries cooperate in their efforts to control pollution. A number of institutions responsible for handling air pollution problems in these countries are referred to with their respective tasks (research and development) specified. Measures taken to control malodorous gases from sulfate pulp factories are reviewed. To solve the problem involved in bisulfite lyes economically, lime has to be replaced by soluble bases such as soda or magnesia. Various processes and systems are described. Biological purification methods for paper-mills are relatively new in the Scandinavian countries. Experiments and practical uses of biological purification are referred to. Scandinavian paper industry helps other industries in solving their pollution problems, chiefly through providing them with adequate materials, and maintains intense cooperation with communities. This is exemplified by a system used by Union Co., Norway which burns its own waste bark together with domestic refuse.

17953 APTIC NO. 36084

Morris, W. E., J. D. Rogers, Jr., and R. W. Poskitt

CARS AND THE NEW GASOLINES 1971. *Preprint, Society of Automotive Engineers, Inc., New York, 56p., 1971. 14 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710624.)*

The recent introduction of lower compression ratio engines and the concurrent marketing of unleaded and low-lead content gasolines of generally lower octane number made it appropriate to investigate the interrelationships of engine performance and gasoline octane quality using the new engines and fuels. Fuel economy of eight 1971 cars was 6.6% lower than that of eight corresponding 1970 cars. Acceleration performance of these 1971 cars was significantly poorer than that of the 1970 cars. Commercial leaded or unleaded gasolines of 91 research octane level are expected to knock in more than half the 1971 cars. Research octane number is a poor index of road octane performance for either premium or regular gasolines in 1970 and 1971 cars. As has been the case for many years, the road octane quality of premium gasolines in 1970 premium cars is related to R plus M/2 (0.5 research plus 0.5 motor octane number). The road octane quality of regular gasolines in 1971 cars and in 1970 regular requirement cars is related primarily to motor octane number. At a given motor octane level, lead content has little effect on road octane number in 1971 cars or in 1970 regular requirement cars. Currently available unleaded commercial gasolines generally are high in sensitivity (research minus motor octane number) and aromatic content relative to leaded commercial gasolines. Because of their higher sensitivity, typical unleaded gasolines must be higher in research octane quality than leaded gasolines to give the same road octane number. For equal road octane number, unleaded premium gasoline must be about four research octane numbers higher than the leaded premium and unleaded regular must be about one research octane number higher than leaded regular. (Author summary modified)

17954 APTIC NO. 36463

Moses, Raphael J.

**WHERE IS THE WATER COMING FROM? A LOOK AT COOLING TOWER WATER REQUIREMENTS IN THE WEST.** *Preprint, American Institute of Chemical Engineers, New York, 17p., 171. 16 refs. (Presented at th American Institute of Chemical Engineers, National and Petroleum and Refining Exposition, 6th Houston, Tex., Feb. 28-March 4, 1971.)*

Water requirements for cooling towers in the next half century will reach enormous proportions. By 2000, consumption water use in the West will reach 1135 million gal fresh water/day. To achieve this use will require the diversion of 43,000 acre ft/day, or 21,500 cfs on a continuous basis. While some western states permit the transfer of water rights from agricultural to utility use, environmental demands, land-use planning, and other governmental restraints are reversing the trend toward maximum utilization of water supplies.

17955 APTIC NO. 36432

Moulds, Donald E.

**CADMIUM.** *In: Bureau of Mines Minerals Yearbook, Washington, D. C., Government Printing Office, 1969, 6p. 2 refs.*

Cadmium is reviewed with respect to legislation and government stockpile programs, domestic production, consumption, uses, prices, and foreign trade. The domestic demand increased to a record level of more than 15 million pounds in 1969. Trends in production, consumption, and costs are tabulated.

17956 APTIC NO. 36230

Mouritzen, Gunnar

**OPTIMIZATION OF NEW PRACTICAL AUTOMOTIVE POWER SYSTEMS.** *High Speed Ground Transp. J., 4(3):417-438, Sept. 1970. 7 refs.*

The most attractive propulsion systems with improved air pollution characteristics are closed-cycle steam engines, open-cycle gas turbines, and possibly the regenerative hot gas cycle engines. Nuclear devices, unconventional fuels, pure mechanical systems, thermal energy storage, compressed air storage, magnetohydrodynamic and direct thermal to electric energy converters are not attractive for general use in the foreseeable future. However, it is very feasible to combine power plant systems with energy storage systems (flywheels, electric storage, thermal storage, compressed air, or compressed refrigerants) in order to match optimum performance and speed characteristics. To develop a new, integrated power plant system, an overall system optimization must be made of a new vehicle design, power plants, power converters, and all necessary accessories. It would include component weights, efficiencies, costs, operating characteristics, and other system requirements. (Author introduction modified)

17957 APTIC NO. 36296

Oya, M.

**PREVENTION OF DISCHARGING NOX FROM COMBUSTION FURNACE.** *(Nenshoro ni okeru NO2 haishutsu boshiho). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 23(12):17-26, Dec. 1971. 12 refs.*

The formation of nitrogen oxides during the high temperature combustion of fuel is chemically analyzed. Emision sources are reviewed by classifications of fuels such as coal, fuel oil, natural gas, petroleum and wood, gas engines, gas turbines, solid waste combustion; diesels and chemical industries, and by classification of the types of sources. Gas engine pipelines, petroleum refineries, and nitric acid manufacturing are some of the sources with relatively high rate of NOx emission. According to the statistics of the Tokyo Metropolitan Government, monthly averages of NOx measured in front of the government office varied greatly by season. The highest nitric oxide concentration was noted in December at 0.228 ppm, and the lowest was in April at 0.066; nitrogen oxides concentration averaged between 0.023 in October and April, and 0.032 in December and March. In winter and spring, the highest concentration of NO was noted around 10 am and 6 pm during the day, and around 6 pm only from August to November. The NOx emission can be controlled by modification of combustion methods, low oxygen supply, stack gas recirculation, or two-step combustion method. Principles of such methods are explained and previously published results are reviewed. With regard to the chemical methods of NOx control, the principles and results of various researches conducted under the supervision of the United States National Air Pollution Control Administration are introduced and explained.

17958 APTIC NO. 36083

Pless, Loren G.

**SOME EFFECTS OF EXPERIMENTAL VEHICLE EMISSION CONTROL SYSTEMS ON ENGINE DEPOSITS AND WEAR.** *Preprint, Society of Automotive Engineers, Inc., New York, 13p., 1971. 20 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710583.)*

Passenger car tests were conducted to evaluate the effects on deposits and wear of three types of vehicle emissions control systems intended to reduce either evaporative emissions, oxides of nitrogen in the exhaust, or crankcase emissions. These tests used 1965-70 model cars, operating with leaded commercial gasolines and 13 different engine oils, in several kinds of service. A crankcase storage evaporative emissions control system increased engine rusting in short-trip service, and increased sludging and valve train wear in low-speed, stop-and-go service. When the crankcase purging rate was reduced in vehicles with crankcase storage to overcome hot-starting and driveability problems, such deposit and wear increases were even larger than with the production positive crankcase ventilation (PCV) valve purging rate. An exhaust gas recirculation (EGR) system for reducing oxides of nitrogen increased engine rusting in short-trip service. Heavy lead-salt deposits accumulated in the EGR system in other tests. Doubling the PCV valve idle air-flow rate from two to four cfm greatly reduced engine rusting in short-trip service. This reduction in rusting was about the same as that obtained, using production two cmf PCV valves, by doubling the concentration of rust inhibitor in the engine oil. Progressively increasing the PCV rate also progressively decreased engine deposits and oil degradation in mixed city-suburban-expressway service. A deep-breathing PCV system providing more thorough ventilation of the engine crankcase reduced deposits and oil degradation. (Author summary modified)

17959 APTIC NO. 36477

Recht, Pierre

SANITARY PROTECTION OF THE ENVIRONMENT IN THE INDUSTRIALIZED COUNTRIES. *(La protection de l environnement dans les pays industrialises). Text in French. Health Physics, 21(2):145-161, Aug. 1971. 30 refs. (Presented at the International Congress of the International Radiation Protection Association, Brighton, England, May 1970.)*

Pollution can be regarded as a consequence of development and civilization. Urban concentration, rapid industrialization, and demographic expansion are some of the features of developed countries. These phenomena are illustrated by statistical and prognostic data as are upward trends in production volume and energy needs. Environmental pollution is shown in a number of examples. Problems and obvious or potential consequences involved in various pollutants such as sulfur dioxide, carbon monoxide, detergents, and pesticides are dealt with. U. S. pollution data are frequently referred to. Seventy million tons of sulfur dioxide, and 180 million tons of carbon monoxide are produced yearly all over the world (the latter is referred to the amount contained in exhaust gases of automobiles only). The self-purifying effect in nature is no longer sufficient, and irreversible alterations can be observed in some cases. Restoring the actual environment and avoiding new degradations constitute main concerns. Problems caused by solid wastes are illustrated by statistical data.

17960 APTIC NO. 36121

Rosen, C. G. A.

FUTURE POWERPLANTS TO COMBAT AIR POLLUTION. *Preprint, Society of Automotive Engineers, Inc., New York and the American Chemical Society, Washington, D. C., 8p., 1970. (Presented at the Bay Area AirO Pollution Symposium, Menlo Park, Calif., Sept. 21-22, 1970, Paper 710363.)*

Promising alternatives to present vehicles include a gas turbine engine with regenerator and a hybrid engine combining a low-powered, fuel-burning engine with electric batteries. New fuels the currently available low-lead and no-lead gasolines, natural gas and liquid propane gas, dual fuel systems, and even fuel cells are also being investigated. Cars incorporating the eventual solution, closed-loop (Kreislauf) systems, should be available by the year 2000. In Europe, efforts are already directed toward fueling the Stirling cycle, using radioactive isotopes as fuels. Single-occupancy cars must be restricted to small, non-polluting vehicles in congested areas, and mass transportation methods are needed to permeate high-density travel systems. The thermal reactor and the catalytic converter are being applied to internal combustion engine vehicles for reducing carbon monoxide and hydrocarbon emissions.

17961 APTIC NO. 36527

Rossenbeck, Martin

FUEL AND THE PROTECTION OF THE ENVIRONMENT, PART I. *(Kraftstoffwandel im Zeichen des Umweltschutzes). Text in German. Automobiltech. Z. (Stuttgart), 73(11):415-421, Nov. 1971. 62 refs.*

The current lead content limit in gasoline in the U. S. is 1.12 g Pb/l, against 0.84 g Pb/l in Japan, and 0.7 g Pb/l in Sweden. In West Germany the maximal permissible lead content will be gradually reduced to 0.40 g/l on Jan. 1, 1972, and to 0.15 g/l on Jan. 1, 1976. Lead compounds emitted by automobile exhaust gases have a particle size below 0.125 micron and thus remain suspended in the atmosphere; industrial lead emission consists of coarse particles, 0.5 to 5 micron in diameter. The maximal permissible atmospheric lead concentration in West Germany is 0.2 mg Pb/cu m. Lead which is inhaled and reaches the lungs is more dangerous than lead ingested with food. Part of the lead is deposited in bones, part is eliminated by the blood. It is unresolved whether only the blood level of lead or the total body lead content should serve as a criterion of lead poisoning. As of July 1, 1971, there are 12 low lead gasolines and 9 lead-free gasolines with an octane rating of 91 on the market in the U. S. The automobile industry reacted to reduced octane ratings by lowering the compression ratio and hp of cars. To compensate for the elimination of tetraethyl, lead refineries are raising the octane rating of gasolines by introducing new technologies including reforming, hydrocracking, isomerization, alkylation, polymerization, the molecular sieve treatment, and cracking.

17962 APTIC NO. 36379

Roussel, A. A. and H. Stephany

CONTINENTAL REPORT: EUROPE. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr., Proc. London, England, 1966, p. 29-34. (Oct. 4-7, Paper II/6.)*

The problem of air pollution in Europe is reviewed with respect to emission sources, geographical and population factors, specific pollutants, research programs, and legislation. Major emission sources include industrial plants, power stations, iron works, metallurgical plants, coke oven plants, petroleum refineries, cement plants, chemical processing, domestic heating, and motor traffic. The most important emissions include dusts, fumes, sulfur dioxide, soot, and carbon monoxide. Air pollution control legislation is reviewed for Germany, Britain, Belgium, the Netherlands, Italy, and France.

17963 APTIC NO. 37187

Schlueter, Arnulf

NON-POLLUTING POWER PRODUCTION BY NUCLEAR FUSION. *(Umweltfreundliche Energieerzeugung durch Kernfusion). Text in German. Umwelt (Duesseldorf), 1(6):4, Dec./Jan. 1971.*

The pollution caused by the combustion of fossil fuels can not be tolerated much longer. Power will be produced by the fusion of atomic nuclei or by the splitting of atomic nuclei in the future. Fusion reactors are not in existence yet, while reactors for atomic fission are fairly numerous. In one aspect a fusion reactor is very similar to a fission reactor, i.e., the discharge of waste heat. Less waste heat is produced in a fusion reactor than by a conventional reactor or fossil fuel-fired power station. The waste heat can be discharged into the atmosphere without negative influence on the environment, by cooling it with dry air.

17964 APTIC NO. 36312

Schmidt, E.

THE FORMATION AND EMISSION OF AIR POLLUTING SUBSTANCES BY BRICK KILNS. *(Auswurf und Entstehung luftverunreinigender Stoffe bei Ziegeloefen). Text in German. Ber. Deut. Keram. Ges., 45(11):579, Nov. 1968.*

Measurements of emissions from 60 brick factories revealed closed that the emission of particulates from old kilns of simple construction often exceeded maximum permissible levels while modern easily conformed to prescribed limits. Sulfur dioxide emissions fluctuated widely within 0.1 and 1.8 g/N cu m. SO3 comprised 5-50% of the total sulfur oxides emitted; thus, the emission of SO3 from brick ovens is higher than from other types of furnaces. All brick clays contained small amounts of fluorine compounds with 0.02 to 0.1% F. Fluorine emission levels fluctuated from 1 to 125 mg/N cu m. Dispersion of SO2 requires stacks 20 to 40 m high stacks; for F, 20 to 50 m stacks are necessary. Emissions increased with increasing combustion temperature and decreased with increasing lime content in the brick clay. High SO2 emission is usually coupled with high emission of F.

17965 APTIC NO. 36419

Schwarz, K.

DUST EMISSIONS FROM COAL-FIRED BOILERS IN THE FEDERAL REPUBLIC OF GERMANY. *(Die Staubemissionen Kohlegefeuerter Dampfkesselgrossanlagen in der Bundesrepublik Deutschland). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc. London, England, 1966, p. 136-131. 13 refs. (Oct. 4-7, Paper V/8.)*

Dust emissions from coal-fired boilers in Germany are examined with respect to emission standards and efficiency of control methods. Results of experiments with electric dust removers are presented. The effects of fuel characteristics and combustion conditions on the operation of the separators and dust properties are discussed. Present emission levels are described.

17966 APTIC NO. 36533

Shcherbina, E. I., T. A. Efimova, A. E. Tenenbaum, L. I. Mikhalskaya, and V. A. Astakhov

POTENTIOMETRIC DETERMINATIONS OF THE GROUP COMPOSITION OF SULFUR COMPOUNDS PRESENT IN STRAIGHT-RUN GASOLINE FRACTIONS. *J. Appl. Chem. (USSR) (English translation from Russian of: Zh. Prikl. Khim.), 44(7):1606-1610, July 1971. 8 refs.*

A potentiometer with a silver sulfide indicator electrode and a silver chloride reference electrode was used to determine elemental sulfur, mercaptan sulfur, disulfide sulfur, and sulfide sulfur in straight-run gasoline fractions. Test results are presented in tables and graps that demonstrate the suitability of the method for sulfur determinations over a wide concentration range. As determined by series of parallel analyses, accuracy of the method is high.

17967 APTIC NO. 36120

Siewert, Robert M.

HOW INDIVIDUAL VALVE TIMING EVENTS AFFECT EXHAUST EMISSIONS. *Preprint, Society of Automotive Engineers, Inc., New York, 17p., 1971. 9 refs. (Presented at the Society of Automotive Engineers Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710609.)*

The effects of individual valve timing events on the exhaust emissions of a single-cylinder engine were determined at part-load low-speed test conditions. The interactions between numerous engine parameters and valve timing and the effects on emissions of engine load, speed, spark advance, exhaust pressure, intake system configuration, mixture temperature, and external gas recirculation were examined. Modifications to either intake valve opening or exhaust valve closing significantly reduced nitric oxide emissions by internal recirculation. Increased charge temperature due to internal recirculation imposed knock problems and mitigated NO reduction effectiveness. The effectiveness of increased valve overlap, exhaust pressure, and intake system configuration were strongly interrelated. Early opening of the exhaust valve increased fuel comsumption and hydrocarbon, carbon monoxide, and NO exhaust emissions.

17968 APTIC NO. 36335

Soejima, Shiro

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 41-42, 1969. (See APTIC 36329.)*

The maximum permissible sulfur dioxide content in the air in Japan is 0.05 ppm; the average SO2 in Tokyo and Osaka was approximately 0.07 ppm in 1969. New York s atmospheric SO2 content in 1966 was 0.42 ppm, an average of 900,000 t/yr; 60% came from homes heating systems and office buildings and 40% came from electric power plants. Among 40,000 buildings in New York, 30,000 use natural gas; yet the SO2 value in the air is high. The relatively low value of SO2 in Tokyo and Osaka is due to the scarcity of home heating systems in Japan. However, in view of the rapid growth of national and individual incomes in recent years, popularization of centralized heating systems is well within sight; consequently, the growth of SO2 concentration in the air is predicted. According to a government estimate, the consumption of oil in 1985 will be five times as large as that of 1965. The concentration of population in urban areas will continue, and the number of buildings will also increase rapidly. As a first step toward serious anti-pollution measures, importation of low-sulfur oil must be considered. At present, 90% of the total oil import comes from the Near East, which has the highest sulfur content in the world (2.5%). The United States produces 1.0% sulfur oil and an abundance of natural gas; European countries use Africa oil, which also has 1.0% sulfur content. An effective, low-cost direct desulfurization method of heavy oil must be developed quickly with strong economical and technical support by the government.

17969 APTIC NO. 36868

Sorensen, George C.

EXTERNAL COMBUSTION ENGINE. *(Assignee not given.) U. S. Pat. 3,572,037. 5p., March 23, 1971. 7 refs. (Appl. May 12, 1969, 2 claims).*

An external combustion engine is described which comprises a rotable housing with compression and expansion chambers and a stator mounted within the expansion chamber. The stator is provided with a helical crest, and the compression chamber with an internal lining adapted to oppose cyclonic flow created by the crest. The inlet to the compression chamber is in effect a venturi so that steam introduced directly to the chamber can draw other gases, such as combustion gases, into the chamber as well. These gases will superheat the steam within the combustion chamber. Efficiency is increased by utilizing exhaust from an internal combustion engine cylinder to scavenge the spent gases from an adjacent external combustion cylinder, and charging the cylinder with hot gases to superheat hot water from the cooling system of the internal combustion engine. (Author abstract modified)

17970 APTIC NO. 36541

Stoefen, Detlev

AGAIN: THE FUTURE FUEL FOR AUTOMOBILES. *(Nochmals: Der kuenftige Autotreibstoff). Text in German. Staedtehygiene (Uelzen/Hamburg), 22(11):265, Nov. 1971. 2 refs.*

The fear has been voiced that a reduction of the lead content in the gasoline would lead to irresponsibly high concentrations of aromatic hydrocarbons (benzene, toluene, and xylol). This fear has come true. Heavy fractions of mineral oil are used for conversion to gasoline. For this conversion the reforming process is primarily used in Europe. During this process cyclic hydrocarbons are converted into aromatics. At a maximum allowable lead content of 0.15 g/l, as is presently required by the law, the aromatics concentration is about 50% if the present anti-knocking properties are to be maintained. The benzene content should be kept below 5%.

17971 APTIC NO. 36378

Sullivan, J. L.

CONTINENTAL REPORT: AUSTRALASIA. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr., Proc. London, England, 1966, p. 25-28. 6 refs. (Oct. 4-7, Paper II/5.)*

Air pollution in Australia and New Zealand is examined with respect to geography, state of industrialization, emission sources, effects on human health, air quality measurements, and legislation. Industrial plants, including chemical processing, oil refineries, metals and engineering works, and ceramic kilns, emit smoke, dusts, and noxious gases. Pollution concentration in the urban areas of Australia is discussed. Emission sources in New Zealand include animal products industries, timber and fertilizer production, and inincoration of wood waste.

17972 APTIC NO. 36268

Suzuki, Kunio, Takasi Tamaru, Shoji Horiuchi, and Takashi Saito

GAS TURBINE COMBUSTORS. *(Gasu tabin nenshoki). Text in Japanese. National Aerospace Lab. (Japan), NAL TR-208, Sept. 1970. 81p. 193 refs.*

NTIS: N71-26298

Various flame holders and their characteristics, air distribution patterns, and flow patterns in the combustion chambers are discussed, and the methods of determining the chamber sizes are given. Various data on designing gas turbine combustors, especially those of vaporizing types are given in order to facilitate determination of combustion phenomena. Sampling and analysis methods of combustion gases are discussed and suggestions are given. In general, a sampling probe must be inserted in the gas flow and the suction speed must be the same as the gas flow speed; reactions of the test material must be stopped and the probe must be cooled. Various types of probes, such as water-cooling, equal speed suction probe, and micro-probe are reviewed with diagrams. For continuous measurement, a hydrogen flame ionization detector is effective for hydrocarbon index; however, when measuring complex components, this is not ideal. For carbon monoxide and carbon dioxide, a non-dispersion infrared absorption analyzer is used. Total carbon concentrations and incompletely burned carbon measurements are taken in two parts. One part of the test material is led through a platinum metal mesh-filled combustion pipe and then into a second combustion pipe. After drying, the CO2 concentration in the material represents the total carbon concentration. The other portion is trapped by a dry ice separator, and after hydrocarbon is condensed, goes through a second combustion pipe. The CO2 concentration is measured after drying. The first figure minus the second figure represents the amount of burned carbon. Various continuous gas measuring methods are presented in a table.

17973 APTIC NO. 36331

Suzuki, Kazuo

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 52, 1969. (See APTIC 36329.)*

Two large, representative steel companies of western nations have rather backward improvement policies. Both Thyssen of West Germany and U.S. Steel stacks emit an abudance of red smoke, polluting the entire area. A management respresentative of U.S. Steel said that the company spent 40 million dollars a year toward pollution control, and yet constant complaints were registered by the citizens in the area. In view of the red smoke, it was quite understandable. Pollution control by Sumitomo Metal Industries, Ltd. is rather advanced; especially the measures taken against pollution by coke furnaces. Yet, complaints are heard daily. This is due to the close geographical proximity of the factory and residential areas forced by the land space of Japan. This situation makes the problem of pollution control in Japan very difficult and extraordinary. A drastic and basic redevelopment policy for cities should be taken, whereby industrial and residential areas would be clearly separated. The western efforts and results are based on democratic philosophy of not causing trouble for others. Particularly impressive results are obtained by the Bayer Co. of West Germany and the Union Oil Co. of California.

17974 APTIC NO. 36275

Takeno, Tadao

COMBUSTION DRIVEN OSCILLATION. *(Shindo nensho). Text in Japanese. Nenryo Kyokaishi (J. Japan Fuel Soc., Tokyo), 50(534):785-790, Oct. 1971. 18 refs.*

Combustion in engines or industrial furnaces is rarely smooth, but is usually accompanied with random fluctuations in the combustion rate as well as in pressure and velocity. When the pressure fluctuation is in phase with the fluctuation in the heat release rate, the fluctuation will develop into an organized combustion driven oscillation with well-defined frequency. Combustion driven oscillation can be classified into Helmholtz resonator type oscillation and an acoustic type oscillation. The Helmholtz resonator type oscillation is characterized by a relatively low frequency of oscillation with the amplitude of oscillation uniform through the combustion chamber at any instant during the oscillation. The occurrence of the oscillation is closely related to the coupling between the variation in the chamber pressure and in the feeding rate of fuel to the chamber. The acoustic type oscillation has a higher frequency and is characterized by the presence of a sound wave propagating in the chamber. The location of the combustion zone is very important for the occurrence of oscillation. The fundamental character and driving mechanism for each type of oscillation are discussed.

17975 APTIC NO. 37176

Ter Haar, G. L., D. L. Lenane, J. N. Hu, and M. Brandt

COMPOSITION, SIZE AND CONTROL OF AUTOMOTIVE EXHAUST PARTICLATES. *J. Air Pollution Control Assoc., 22(1):39-46, Jan. 1972. 14 refs. (Presented at the Air Pollution Control Accosiation, Annual Meeting, 64th, Atlantic City, N. J., 1971, Paper 71-111.)*

Several vehicles manufactured during 1966-1970, operated on a chassis dynamometer under Federal 7-mode cycle conditions, were tested to determine total particulate composition, size of exhausted lead particulates, and the effects of traps on total lead emitted. Cars varied widely in the amounts and composition of their particulate emissions. Cold-cycle operation gave 2-8 times more particulate than hot engine operation. Lead compounds represented less than 1/3 of the total particulates, the remainder being carbon compounds along with ammonium and nitrate ions and unknown materials. Exhausted lead varied with the condition of the exhaust system and ranged between 7 and 30% of the lead consumed by the engine. Fuel additives affected the amount of emitted particulates. Probe sampling techniques underestimated by a large factor the amount of particulates emitted by vehicles. Trapping systems offered potential for greatly reducing the emission of suspended total particulates. The size of lead particulates was determined using 26 1966-model cars with stabilized exhaust deposits. Under Federal Cycle conditions, 18% of the lead burned was emitted as fine and 11% as course particles. (Author abstract modified)

17976 APTIC NO. 36343

Vandegrift, A. E. and L. J. Shannon

PARTICULATE POLLUTANT SYSTEMS STUDY. VOLUME I – MASS EMISSIONS. *Midwest Research Inst., Kansas City, Mo., Air Pollution Control Office Contract CPA-22-69-104, MRI Proj. 3326-C, 383p., May 1, 1971. 183 refs.*

NTIS: PB 203128

Eighteen major stationary sources of particulates were identified through a literature and information survey and a ranking of the sources by total tonnage was developed using emission factor and other calculation techniques. For each source, the efficiency of controls was determined. In addition, comparison was made between stationary source emissions and emissions from significant non-industrial sources of particulate pollution. Total particulate tonnage from stationary sources is 18,056,000/yr. Totals are given for utility and industrial fuel combustion, crushed stone, sand, and gravel, agriculture, iron and steel, cement, forest products, lime, primary nonferrous clay, fertilizers and phosphate rock, asphalt, and secondary nonferrous metals. The non-industrial source total (natural dusts, forest fires, transporation, and incineration) is 122,815,000 tons/yr. Attempts were also made to rank particulate air pollutants and their sources on the basis of objectionable properties: soiling, odor, toxicity, property damage, and nuisance effects. The four source categories that appear to cause the most complaints are primary metals industries; the stone, clay, and glass products industries; petroleum and related industries; and refuse disposal. With no improvement in net control, industrial particulate emissions will rise from the present level to cover 56,000,000 tons/yr by the year 2000. Four control strategies for reducing future emissions below the current level are suggested. A five-year research and development program for control technology is outlined.

17977 APTIC NO. 36060

Wetmiller, R. S. and L. E. Endsley, Jr.

**EFFECT OF DIESEL FUEL ON EXHAUST SMOKE AND ODOR.** *SAE (Soc. Automot. Engrs.) J., 50(12):509-520, Dec. 1942. (Presented at the American Society of Mechanical Engineers National Oil and Gas Power Conference, 15th, Peoia, Ill., June 19, 1942.)*

A laboratory investigation of diesel exhaust smoke and odor carried out on two popular automotive-type diesel engines is reported which indicates that although fuels may be chosen to give desired results along any selected lines of engine peerformance, it is not possible to obtain all desirable results with a single fuel, at least not without recourse to additives. The only present solution appears to be fuel selection on the basis of a compromise among the various factors involved. Proper interpretation of engine performance characteristics most desired and consideration of the type and mechanical condition of the engine used should result in selection of fuels for utmost satisfaction. Although pronounced exhaust smoke and odor occur under full load, the most objectionable conditions were those occurring during idling, acceleration after idling, and occasionally, deceleration with the clutch engaged. An increase in cetane number apparently will produce a decided decrease in exhaust smoke by virtue of its ability to support combustion under adverse conditions of low output. In an attempt to minimize the obnoxious smoke and odor from exhaust gases from diesel-powered vehicles, numerous operators resort to kerosene-type fuels. While this expedient does result in a substantial reduction in exhaust smoke, it is accompanied by a pronounced loss in power and economy due to the lower available heating volume on a volume basis. (Author abstract modified)

17978 APTIC NO. 36094

Whittingham, G.

**ADVANCED HEAT PROCESSES.** *Inst of Fuel, London (England); American Society of Mechanical Engineers, New York; and Inst. of Combustion and Fuel Technology of Canada, Ottawa, Ontario, p. 15.1-15.15, 1970. 17 refs. (Presented at the North American Fuel Technology Conference, Ottawa, Ontario, May 31-June 3, 1970, Paper F-NAFTC-4.)*

Fuel combustion is fundamental to all primary processes of energy conversion and several combustion techniques are outlined which are classified as advanced. They are selected from electricity generation, metallurgical, and agricultural processes. They include combustion in highly preheated air or oxygen (magnetohydrodynamics (MHD), blast furnace injection, oxy/fuel burners), the production of high velocity, high temperature gases or flames of controlled shape and direction (convective heating by jet impingement or flame cultivation), and oxidation of fuel in the liquid phase by ion and electron transfer processes (fuel cells). The industrial application of MHD is retarded because of technical problems associated with seed recovery, the design of heat exchangers, and the need for heat and corrosion-proof materials. Exploitation of fuel cell technology will be severely restricted if it is based on the use of hydrogen. Conversion of hydrocarbon fuels into hydrogen adds appreciable to energy costs. The other developments reviewed are in the direct line of evolution of high temperature technology and can use a wide range of fuels. Future attempts to raise combustion intensities still higher may well introduce environmental problems of noise and pollution by oxides of nitrogen. (Author abstract modified)

17979 APTIC NO. 36032

Wiklander, Lambert

**LEAD IN SOIL AND PLANTS. I. INFLUENCE OF MOTOR VEHICLES.** *(Bly i mark och vaxter. I. Inverkan av motortrafik). Text is Swedish. Grundfoerbattring, 23(3-4):163-169, 1970. 3 refs.*

Snow accumulated during the winter in Uppsala, Sweden, was analyzed for lead at various distances from a main road. Samples of soil were collected in the spring at depths of 0-1 and 10-15 cm, and samples of wheat were collected in August. Shoots of a Norwegian spruced hedge were also cut and analyzed. The atmospheric deposition of lead was high close to the road and rapidly decreased to a normal value at 45 m. The accumulation of lead in the soil surface showed a similar pattern, while at a depth of 10-15 cm the lead concentration was invariable with the distance. Lead content of the wheat and Norwegian spruce was high in the proximity of the road. Soil profiles from a park area in Gothenburg with heavy traffic ranged from 12-117 ppm of soluble lead and 69-425 ppm total lead.

17980 APTIC NO. 36500

Yagi, R., S. Tazawa, and O. Kumazaki

**SOME ASPECTS ON POLLUTED GASES EMITTED FROM KEROSENE BURNING STOVE.** *(Muentotsu sekiyu sutobu hassei gasu sokutei kekka ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):248, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

In a 3.7 by 2.58 by 3.15 m chamber equipped with a kerosene stove and ventilator, the concentration of sulfur dioxide, nitric oxide, nitrogen dioxide, and carbon dioxide were measured at one hour intervals for four hours by varying the number of ventilations from one to three times per hour. The pollutant concentrations were in the range of $SO_2$, 0.02 0.06 ppm; NO, 0.76 - 1.08 ppm; $NO_2$; 1.24 2.16 ppm; $CO_2$, 0.39 - 0.58% depending on the number of ventilation and time.

17981 APTIC NO. 36846

Yoshinaga, Shunichi and Sadao Iki

**SOIL CONTAMINATION BY HEAVY METALS IN ATMOSPHERIC DEPOSIT IN KITAKYUSHU CITY.** *(Kitakyushushi ni okeru dojochu no kinzoku seibun). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):212, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The manganese, titanium, zinc, nickel, cobalt, copper, chromium, cadmium, lead, and vanadium contents in soil collected at ten polluted locations in Kitakushu City were measured and compared with those in the unpolluted area, Fukuoka and Kyoto City. The metallic composition of soil was very similar to that of suspended particulates and deposited particulates. The metallic content in soil of Kitakushu City were generally higher than the Clark s number, particularly Zn, Cu, Cd, Pb, and V content.

# CONTROL METHODS

17982 APTIC NO. 36098

**DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES.** *Atomics International, Canoga Park, Calif., Air Pollution Control Office Contract CPA 70-78, Rept. AI-71-37, Progress Rept. 4, APTD 0752, 166p., July 28, 1971. 11 refs.*

NTIS: PB 203466

Fly ash filtration tests were performed with a Croll-Reynolds filter cartridge having 25-micron spacings between the wire windings; data from the tests were used to obtain the relationship between throughput, pressure drop, and ash loading over the range of ash loadings from 0 to 1.25 lb ash/sq ft filter area. This relationship was then used in reevaluation of the filter requirements for an 800-Mw installation. Very high mist recovery efficiencies were obtained with wire-mesh mist eliminator pads, but the tests were hampered by the lack of a source of large volumes of hot gas. Five long-term dynamic corrosion tests and three thermal transport tests were completed. In the dynamic tests, stressed and unstressed specimens of Type 347 and Type 321 stainless steel were exposed at 932 F to carbonate melts containing 20% sulfide and five percent chloride, 20% sulfite and five percent chloride, and 40% sulfite and five percent chloride. An engineering analysis of the two-zone reducer using petroleum coke was performed, and an engineering analysis for the regenerator was completed. Based upon a flow diagram which included a two-zone reducer using petroleum coke, revised preliminary heat and mass balances were derived for an 800-Mw installation. (Author summary modified)

17983 APTIC NO. 362470

**EMISSION REDUCTION USING GASEOUS FUELS FOR VEHICULAR PROPULSION. (FINAL REPORT).** *Inst. of Gas Technology, Chicago, Ill., IIT Center, Air Pollution Control Office Contract 70-69, 147p., June 1971. 190 refs.*

NTIS: PB 201410

The greatest benefit from conversion to gaseous fuels may be realized in the immediate future while pollution control devices are being perfected for use on gasoline-powered vehicles. The four fuels which were examined were propane, natural gas, ammonia, and hydrogen. Availability, cost, storage, handling methods, and safety requirements of gaseous fuels were also assessed. The feasibility of using natural gas as a supplementary fuel in a two stroke cycle, diesel powered intercity bus as a means of reducing exhaust pollution while operating in urban areas and bus terminals was determined. The findings and conclusions of the study indicate that further development of the use of natural gas and liquefied petroleum gas as motor fuel is justified wherever logistical and economic considerations permit their use. A number of specific recommendations are made. Exhaust gases (hydrocarbons, nitrogen oxides, and carbon monoxide) can be reduced by adjusting fuel-air ratio, ignition timing throttle position, and engine speed. Engine operating cycles are also mentioned.

17984 APTIC NO. 36270

**HOW WEYERHAEUSER CONTROLS KRAFT ODOR WITH THE VAPORSPHERE.** *Paper Trade J., 139(1):12-13, Jan. 3, 1955.*

At two kraft mills, sulfur-containing gases that are not eliminated by condensers are collected by 25-ft steel bubbles (vapospheres) on the roofs of the mills. Inside each sphere is a rubber treated diaphragm that expands slowly as the gases are collected and stored. The inflated balloon allows the gases to be drawn off slowly and at a constant rate for destruction by burning or chemical treatment. The devices are at least 90% effective in completely deodorizing the pulping process.

17985 APTIC NO. 36273

**TODAY S POLLUTION CONTROL PRACTICES IN THE AMERICAN STEEL INDUSTRY.** *33 Mag., 10(1):33-36, Jan. 1972.*

The majority of primary metal operations report using fabric filters and wet collectors to control particulate emissions. In addition, cyclone collectors are used by about one in three plants. While mechanical devices are the primary means of preventing atmospheric emissions, a significant portion of the industry uses other methods of control. These range in scope from selecting special types of raw materials to revisions in the manufacturing process. Nearly seven plants in ten which can be classified as iron and steel mills, foundries, smelters, or refiners of nonferrous metals have some problem with thermal pollution. Additionally, the majority report having metallic solids present in their waste water. Abrasive materials, especially silicon compounds, are not at all uncommon. The vast majority of iron and steel mills with treatment facilities chemically treat effluent during the primary stage in addition to the use of ponds and tanks. The primary metals industry tends to recycle or reclaim its production waste.

17986 APTIC NO. 36286

**WHEN IT COMES TO POLLUTION CONTROL, STEEL ISN T DAWDLING – IT S ACTING.** *33 Mag., 10(1):23-9, Jan. 1972.*

During the past 20 years the iron and steel industry has invested over $1.2 billion in pollution control facilities and equipment. At the Texas Works of U. S. Steel, clarified water for the potable water system is forced through sand filters and is chlorinated prior to use. Effluent from the system is thoroughly treated, both physically and chemically, in the plant s sanitary waste treatment plant before being discharged. The process water system consists of scale pits, secondary settling basins, high rate pressure filters, and cooling towers. At republic Steel Corporation s Chicago Works, waste water from the mill s hot rolling operations is carried to pits where large particles of mill scale settle out and grease and oil are skimmed off. It is then pumped through filters which remove fine particles of scale and other suspended solids. A circular scale pit and scale collection system are the prime features of a complete waste water treatment complex being planned for The Steel company of Canada. A huge $2.6 million baghouse in operation at Kaiser Steel s Fontana plant controls emissions from the 301-ft high sinter plant stack. Five companies have together invested seven million dollars in constructing a bench laboratory and pilot plant process that pelletizes coal in a closed system that prevents dust and gases from escaping into the air. An enclosed pipeline charging system, which incorporates preheating of coal, provides virtually pollution-free coke oven operation. A manifold canopy hood collection system will be installed over three electric arc furnaces at Lukens Steel s electric melt shop. Changing from a traditional black oil and grease lubrication program to the use of a dry-film graphite lubricant has cut down the pollution at U. S. Steel s Homestead Works.

17987 APTIC NO. 36355

(Inventor not given.)

**A METHOD TO REDUCE THE PROPORTION OF SULFUR TRIOXIDE IN OFF-GASES FROM THE COMBUSTION OF SULFUR-CONTAINING OFF-LYES.** *(Bystroms Oljeprodukter A. B., Karlstad (Sweden)) Brit. Pat. 1,204,761. 1p., Sept. 9, 1970. (Appl. Jan. 1, 1968, 4 claims).*

In the method described, magnesium sulfate is added to sulfur-bearing lye along with magnesium tall oil fatty acid soap. The lye is then burned. Incrustation is reduced by the addition of the two mixtures. The method is particularly applicable to reducing sulfur trioxide in sulfite and sulfate cellulose processes.

17988 APTIC NO. 36429

**GERMANY: ODOR DEVELOPMENT AT THE DUISBURG-HUCKINGEN COMPOST PLANT.** *Int. Res. Group Refuse Disposal, Inf. Bull., no. 4:80-81, March 1958.*

A process of air circulation combined with a two-stage cooler and water scrubber was installed at the Duisburg-Huckingen refuse-sludge compost works in Germany when a penetrating odor developed, despite the undoubtedly aerobic decomposition process.

17989 APTIC NO. 36513

**SO2 REMOVAL SYSTEM FEATURES RIGID ABSORPTION PACKING.** *Elec. World., 177(2):36-37, Jan. 15, 1972.*

A new system for fly ash and sulfur dioxide removal utilizes wet limestone absorption and a unique, rigid absorption packing or fill. Because the fly ash and SO2 stages are separate, the requirements of SO2 absorption do not dictate the choice of fly ash collection method. The absorption stage can be backfitted to scrubbers, electrostatic precipitators, or fabric filters. The fixed matrix fill in the absorption tower prevents plugging and scaling problems since no crystallization occurs in the fill. The high specific surface of the fill, about 68 ft/cu ft, makes possible a compact unit with low pressure drop. The system will be used by a power plant operating on one percent-sulfur coal, but is capable of meeting present SO2 emission criteria with higher-sulfur coals as well.

17990 APTIC NO. 36821

**ADHERENCE TO EMISSION LIMITS.** *(Einhaltung von Emissions- Grenzwerten). Text in German. Oberflaeche, 11(9):514-516, 1971. 2 refs.*

The VDI (Verein Deutscher Ingenieure) has established a commission to study the requirements for air purification, with special emphasis on dust. A handbook published by the VDI commission lists permissible limits applied specifically to conditions in the mining industry, metallurgical and smelting plants, the power industry, refineries, and other industries. The most popular methods of industrial dust removal are reviewed. Cyclones are based on the principle of centrifugal separation and are most effective for larger particle sizes. Multi-cyclones of 100 to 150 mm effective diameter, using a common dust receiver, are more economical than single units of larger size. With particle sizes above 5 micron, up to 99% effective separation can be attained with cyclones. For fine particles, the efficiency drops sharply. Filtration by means of filter bags has become a very important application, permitting 99% effectiveness for dust particle sizes down to about 0.5 micron. For best results they are often used in combination with cyclones. Electrostatic precipitators are being successfully used for dust separation, where efficiencies of up to 99% can be attained with dust down to about 1 micron particle size, if the flow speed of the gas to be purified is kept within certain limits, and depending on the chemical and physical properties of the dust to be separated. Dust concentrations of more than about 1000 g/cu m require the installation of a cyclone for the first stage separation ahead of the electrostatic precipitator. Operating costs of electrostatic precipitation are considerably lower than those of any of the other methods described.

17991 APTIC NO. 36897

Fuyo Chemical Engineering Co., Tokyo (Japan)

**FK METHOD IN STACK GAS DESULFURIZATION.** *(Haien datsuryu ni okeru FK S shiki.) Text in Japanese. Kogai to Taisaku (J. Pollution Control), 7(12):1140-1142, Dec. 1971.*

An improved FK-type combustion gas desulfurization system is described. Combustion gas is sent into the gas chamber at the lower end of the system and blown into a multiple number of tubes with a small diameter. Water is jet sprayed from all around and splashes in the tube. The water particles collide with the walls immediately and begin to flow down the wall; but, due to the small diameter of the tube and the high speed gas entering from the bottom of the tube, they form a film which is again broken into small particles by the high speed gas. These actions are repeated as the gas moves up to the higher part of the tubes. Approximately 50% of the gas is absorbed before it reaches the hole which jet sprays compressed air and recovered water in the middle of the tube. By this second air-water jet spray, 95% of the gas is absorbed, and soot and dust are almost completely eliminated. The gas-liquid mixture leaving the tubes is separated in a separation chamber, and the gas is discharged in the air; the water is used as material for production of by products. A new by product, which will be announced at a later date, is a calcium compound precipitated by a newly invented precipitator comprising zinc and aluminum compounds.

17992 APTIC NO. 36867

Altmann, Berton G. and John D. Bailey

**WASTE COMBUSTION AFTERBURNER.** *(Kaiser Aluminum and Chemical Corp., Oakland, Calif.) U. S. Pat. 3,567,399. 4p., March 2, 1971. 6 refs. (Appl. June 3, 1968, 3 claims).*

An afterburner for oxidizing gaseous wastes is described which comprises an elongated, frustoconical refractory chamber of increasing internal cross-sectional area from entrance to exit. Heat is introduced into the chamber near the entrance to raise the temperature of the gaseous waste products to the point where they will spontaneously oxidize when mixed with fluent oxidizer. Sequentially located along the refractory chamber are selectively spaced means for introducing a fluent oxidizer, such as air, into the chamber whereby the heated gases can be oxidized to non-noxious products of combustion. (Author abstract modified)

17993 APTIC NO. 36209

Ambrose, M. J. and John Bott

**ZERO EXHAUST VISIBILITY--A GOAL ATTAINED FOR PEAKING GAS TURBINES.** *Preprint, American Society of Mechanical Engineers, New York, Inst. of Electrical Engineers, New York, 8p., 1970. 2 refs. (Presented at the Institute of Electrical Electronics Engineers-American Society of Mechanical Engineers, Joint Power Conference, Pittsburgh, Pa., Sept. 27-30, 1970, Paper 70-Pwr-15.)*

Increasing application of gas turbines for peaking power have accentuated the need to deal with the problem of exhaust visibility. The requirements of the power station operator in regard to stack visibility are described. Smoke problem causes and techniques to solve the problem are discussed. Laboratory tests to accomplish the goal of zero visiblity are described, and confirmation of lab results by field tests are also presented. The important break-through came by re-establishing the basic mode of primary flow and maintaining combustor pressure drop at about three and a half. The flow mode which remained stable was obtained by halving the primary air entrance locations in the uppermost area of the combustor cylinder, with the addition of nozzle sweep air approaching four percent of total combustor flow. This latter air-sheath controlled the primary air flow in the immediate area of the nozzle, thus maintaining lean stability conditions, and the former reduction in combustor primary air entrance ports provided increase recirculation and residence time to burn out any fuel rich pockets which might tend to originate along the fuel spray axis. (Author abstract modified)

17994 APTIC NO. 36918

Ashmore, John W.

**APPARATUS FOR PURIFYING EXHAUST FUMES.** *(Assignee not given.) U. S. Pat. 3[illegible] [illegible]p., March 2, 1971. 2 refs. (Appl. Jan. 29, 196[illegible], [illegible]).*

A device is presented for removing toxic or lethal gases from the exhaust fumes of internal combustion engines. While there are many types of anti-smog devices in the form of mufflers or other types of apparatus currently available for removing the objectionable products of combustion, they are somewhat complex in design and substantially reduce engire efficiency without removing a sufficient amount of impurities. In the present apparatus, the exhaust gas is fed directly into a liquid solution, after which water vapor carried by the cleaned exhaust gas is extracted before discharge, thereby avoiding any substantial reduction of liquid supply within the apparatus. Complete water vapor extraction is insured by passing the cleaned exhaust fumes sequentially through a series of condensation chambers. (Author abstract modified)

17995 APTIC NO. 36143

Baba, Hideo

**A NEW ZINC-AIR FUEL BATTERY SYSTEM.** *Preprint, Society of Automotive Engineers, Inc., New York, 7p., 1971. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710237.)*

A new zinc-air fuel battery uses pulverized zinc as its fuel. The pulverized zinc is suspended in an aqueous KOH electrolyte, which serves as the fuel carrier, and is sequentially fed to each cell of the battery stack intermittently. The used fuel and the electrolyte can be removed from the battery and regenerated externally by an electrolytic process without any loss of zinc or electrolyte. Details of the construction and performance of three-kw and 400-w prototype units are presented. Energy densities of the prototypes are 32 whr/lb and 12 whr/lb, respectively. The smaller power plant has a fuel capacity sufficient for five hours and the larger a capacity sufficient for 10 hours. Efforts are being made to increase both energy density and volume efficiency, and to reduce consumption of battery output by auxiliaries. With mass production, the zinc-air battery should have a capital cost of less than $100.

17996 APTIC NO. 37156

Beavon, David K.

**ABATING SULFUR PLANT TAIL GASES.** *Pollut. Eng., 4(1):34-35, Jan./Feb. 1972.*

Claus discovered that hydrogen sulfide produces good yields of sulfur when mixed with air and passed over an iron or bauxite catalyst at an elevated temperature. The reaction is highly exothermic, but completion is opposed by high temperatures, so conversion in a fixed bed of uncooled catalyst is relatively low. The I. G. Farbenindustrie approached the problem of heat removal by first burning 1/3 of the hydrogen sulfide with air in a pressurized boiler, in which about 4/5 of the overall heat of reaction is removed by generating steam, and some of the sulfur is produced. After condensed sulfur is separated from the cooled gases, the chemical reaction is carried further toward completion by heating the gases to 400-500 F and passing them over a Claus catalyst. It is customary to carry out the reaction in a series of two or three catalyst beds, with cooling, condensation, and removal of produced sulfur after each bed. The new Beavon sulfur recovery process starts by converting all the sulfur in the tail gas into hydrogen sulfide, then cools the gas to condense out water, removing it from the reaction zone. Conversion to H2S is by both hydrolysis and hydrogenation reactions. Following the catalytic reactions which convert essentially all the sulfur compounds in the tail gas to H2S, the gas mixture is cooled to as low a temperature as is economical, and condensed water is removed. Hydrogen sulfide is extracted from the hydrogenated, cooled tail gas by the Stretford process which uses a sodium carbonate solution which reacts with H2S to form sodium hydrosulfide. This is oxidized to sulfur by sodium vanadate, and the vanadium is oxidized back to the pentavalent state by blowing with air, with sodium anthraquinone disfulonate working as an oxidation catalyst.

17997 APTIC NO. 36064

Belding, J.

**THE HIGH SULFUR COMBUSTOR.** *Preprint, American Inst. of Chemical Engineers, New York, 29p., 1971. 7 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 70th, Atlantic City, N. J., Aug. 29-Sept. 1, 1971, Paper 38e.)*

Coal preparation for sulfur content reduction is examined with respect to high sulfur combustor fuel compositions, products, investment, and operating costs. The pyritic sulfur content of some bituminous coals could be reduced by gravimetric separation or washing. Under favorable conditions, the revenue from extraction and sale of heat and sulfur value contained in the reject fraction of coal washing could to some degree offset the cost of washing. (Author abstract modified)

17998 APTIC NO. 36216

Benarie, M.

**THE EFFECT OF PORE SIZE DISTRIBUTION ON FILTRATION CHARACTERISTICS OF FIBROUS FILTERS.** *(Influence de la distribution des tailles des pores sur les proprietes de filtration des couches fibreuses). Text in French. Preprint, Faculte des Sciences de Paris (France), p. 1-16, 1968. 13 refs. (Presented at the Seminaire de Physique des Aerosols, Paris, France, 1968.)*

The pore size distribution in highly porous fibrous layers is considered for straight fibers of equal diameter randomly distributed in a plane, for polygons of equal surfaces, and for a bidimensional arrangement resulting from the random superposition of two fibrous layers. The function of fiber distribution, the effective pore diameter for capillaires of a circular profile, pore distribution in a bidimensional and tridimensional foil, differential effectiveness, and the distribution of porosity are analyzed and the filtering efficiency of a non-uniform layer calculated on the basis of a quantitative evaluation of the decrease in filtering efficiency caused by lack of uniformity. The effect of pore size distribution on the filtering effectiveness of aerosol filters is expressed by a log-normal function. For logarithms smaller than 0.1, the filtration theory is in good agreement with the behavior of real filters.

17999 APTIC NO. 36146

Benson, J. D. and R. F. Stebar

**EFFECTS OF CHARGE DILUTION OF NITRIC OXIDE EMISSION FROM A SINGLE-CYCLINDER ENGINE.** *Preprint, Society of Automotive Engineers, Inc., New York, 11p., 1971. 11 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710008.)*

The effects of charge dilution on the exhaust emission of nitric oxide (NO) from a single-cylinder engine were evaluated over a range of engine design and operating parameters. Nitric oxide emission decreased as much as 70% as charge dilution fraction (volume fraction of product gases in the combustion chamber prior to ignition) was increased from 0.065 to 0.164 due to increased valve overlap, external exhaust recirculation, and reduced compression ratio. With these three variables, NO emission was strongly dependent on charge dilution fraction, but independent of the specific method used to change charge dilution. Other variables such as valve overlap position, spark timing, and exhaust pressure also affected charge dilution and NO emission, but the relationship between charge dilution fraction and NO emission for these variables was not consistent. Vehicle application of charge dilution techniques will probably be limited by the effects of high charge dilution on driveability. (Author abstract modified)

**18000** APTIC NO. 36525

Berti, V. and V. Iannibello

CATALYTIC HYDRODESULFURIZATION OF PETROLEUM RESIDUES: FIXED AND SUSPENSION-BED PROCEDURES. . *(Idrodesolforazione catalitica di residui di petrolio: trattamento su letto catalitico fisso e su letto catalitico sospeso). Text in Italian. Riv. Combust. (Milan), 25(9):342-352, Sept. 1971. 7 refs.*

Operating details and performance data are given for two catalytic desulfurization processes for petroleum residues; the processes operate with the catalyst disposed on a fixed bed and a moving or suspended bed. The distribution of residual sulfur in desulfurized residue products versus the distribution of sulfur in the untreated product was studied in a laboratory pilot plant, using the same catalysts with both fixed and moving beds. In the fixed bed process, the sulfur contained in fractions of intermediate molecular weight was preferentially converted under normal operating conditions. In the moving bed process, elevated conversions were also obtained of the sulfur contained in the heavier fractions. (Author abstract modified)

**18001** APTIC NO. 37203

Beukenkamp, John, Carl Stoddard, and Joseph Leo Waldman

THE REMOVAL OF CARBONYL SULPHIDE FROM INDUSTRIAL GASES. *(Entfernung von Carbonylsulfid aus industriellen Gasen). Text in German. (Titangesellschaft m.b.H., Leverkusen (West Germany)) W. Ger. Pat. 2,054,016. 32p., May 13, 1971. (Appl. Nov. 3, 1970, 13 claims).*

The continuous process removes carbonyl sulfide from dry industrial gases which contain 39-42% carbon monoxide, 50-55% carbon dioxide, 5.0-6.0% nitrogen, and 0.4-0.5% carbonyl sulfide by adsorption in towers packed with activated carbon at between 1.5 and 46 C. The ratio between the depth and the diameter of the carbon column should be within a range of from two to one and thirty-two to one, the diameter of the activated carbon granules should be between 0.99 and 3.33 mm. The adsorption period which lasts for from 1.5 to eight hours is followed by a regeneration period lasting for from four to 16 hours. Regeneration is accomplished by superheated steam between 204 and 288 C. The dry crude gas to be cleaned is cooled to from ten to 1.1 C, then passed through a system of four interconnected towers equipped with an automatic valve system at a 2.5 m/sec flow velocity. The towers work in a four phase cycle with adsorption followed by regeneration, cooling with cold purified gas, and a rest period.

**18002** APTIC NO. 36453

Black, E. N., IV, W. E. Askey, J. R. Smith, and J. W. Stephens

REDESIGN OF EXISTING CATALYTIC REFORMING UNITS FOR OCTANE IMPROVEMENTS. *Preprint, American Inst. of Chemical Engineers, New York, 21p., 1971. (Presented at the American Institute of Chemical Engineers, National Meeting, 68th, Houston, Tex., Feb. 28-March 4, 1971.)*

Recent announcements by major petroleum companies have indicated a decrease in the amount of lead alkyls used in gasoline. This trend is expected to accelerate and refiners today must consider alternate methods of octane improvement. Redesign of existing catalytic reformers for higher octane and/or hiher throughput is discussed. These redesigns require more severe operating conditions with the attendant higher coke make which can be accommodated by changing to the new coke tolerant catalysts that contain not only platinum but also an additional metal such as rhenium (bimetallic catalysts), or by conversion of a semi-regenerative plant to fully regenerable (cyclic) operation. Several proposed conversions from semi-regenerative operation using conventional platinum-alumina catalyst (platinum catalyst) to either semi-regenerative operating using bimetallic catalyst or cyclic operation are presented. The cases that are presented are based on feasibility studies of actual commercial units. Costs are cited. (Author introduction modified)

**18003** APTIC NO. 36104

Blenk, M. H. and R. G. E. Franks

MATH MODELING OF AN EXHAUST REACTOR. *Preprint, Society of Automotive Engineers, Inc., New York, 40p., 1971. 15 refs. (Presented at the Society of Automotive Engineers, International Mid-Year Meeting, Montreal, Canada, June 7-11, 1971, Paper 710607.)*

Thermal and chemical processes occurring in exhaust manifold thermal reactors were closely simulated with a computer model developed to predict the performance of thermal reactors operating on multicylinder engines in vehicle service. Output predictions include both transient and steady-state response including reactor warmup at steady-state engine operation. Gas and metal temperatures, heat fluxes, and concentrations of selected exhaust components can be followed as a function of time at various locations within the reactor. Studies carried out using the model indicate that for the chosen set of operating assumptions, combustion of hydrocarbons and carbon monoxide at steady-state operating conditions is limited by imperfect mixing of exhaust gases with auxiliary air. Most reaction was found to occur in the exhaust ports and inner chamber of the reactor with little additional combustion downstream of these sections. Optimum secondary air injection rates for minimum carbon monoxide survival were predicted for various operating conditions. Transient reactor response to a misfire condition was also followed through use of a model. The features of the mathematical program are described, including the FORTRAN programs used. Development of the principles used in formulating the model, including both thermal and chemical considerations, are treated in detail. (Author abstract modified)

**18004** APTIC NO. 36063

Boterman, H.J. and J. Groeneboom

SMOKE FROM INCINERATORS. *(Rookgas bij vuilverbrandings- installaties). Text in Dutch. Verwarming Ventilatie, 26(4): 267-279, April 1969.*

The technical possibilities of cleaning and purifying smoke from incinerators are described, including the operation and construction of the most popular types. An economic evaluation of diverse types of incinerators and aspects of public hygiene in the choice of incinerators are discussed. The type of installation, its location, and the type of gas cleaning are discussed with respect to cyclones, multicyclone, (paracylones), rope filters, venturi separators, and electrostatic filters. The construction, particle removal, cleaning mechanism, and peculiar characteristics of each of the above types are discussed with graphs and tables. The wet and dry types of electro filters are explained. Combinations of electro filters with centrifugal separators are described. Methods of gas cooling in incinerators are explained and described. Quality factor K and efficiency in percent are used to compare different types of incinerators. Comparative curves of price per unit volume vs. capacity (cubic meters per hour) are included. A description of actual incinerators installed in the Netherlands is given.

**18005** APTIC NO. 36367

Brenner, E. M.

GAS COLLECTION, CLEANING AND CONTROL AT SAKO SUNDSVALL WORKS. *Preprint. Metallurgical Society of the AIME, New York, 15p., 1970. (Presented at the Metallurgical Society - American Institute of Mining, Metallurgical, and Petroleum Engineers, Annual Meeting, Denver, Colo., Feb. 16-19, 1970, Paper A70-14.)*

At an aluminum plant located near a city center, it is necessary to wash both pot gases and potroom gases and to release waste gases at an elevation of 210 ft in order to minimize fallout of fluorine compounds. The gas collection and cleaning system for the vertical stud Soederberg pots consists of gas skirts, burners, cyclones, and wet scrubbing columns in a floating bed system. The ventilation system is also described. The potroom gases are cleaned in huge wet scrubbing towers and released to the atmosphere through large chimneys. The efficiency of the scrubbing system and the emissions to the atmosphere are analytically controlled. Immission is controlled by inspection and analysis of the vegetation in a system of stations surrounding the plant. (Author abstract modified)

18006 APTIC NO. 36536

Brown, John E.

POLLUTED AIR ABATEMENT DEVICE. *(Assignee not given.) U. S. Pat. 3,572,655. 8p., March 30, 1971. 8 refs. (Appl. Sept. 2, 1969, 13 claims).*

Most devices developed for removal of dust, smoke, and pollutant gases from air have not been commercially accepted. A new abatement device, giving results well within federal standards, includes a closed tank partially filled with liquid and having a flue at each end. The upper portion of the tank is divided by baffles into compartments closed at the bottom by the liquid in the lower portion of the tank. A sprayer head in each baffle provides a converging spray of liquid in the direction of the polluted airflow; the spray draws air from one compartment to the next. A spray nozzle in each compartment directs a stream of liquid toward the spray head, and, on impact, the mutually converging sprays produce a vapor mist that saturates particulate matter and dissolves any gases present. Impurities are collected in the liquid at the bottom of the tank.

18007 APTIC NO. 36941

Carlton-Jones, Dennis

TALL CHIMNEY CONSTRUCTION. *Power Eng., 74(12):36-39, Dec. 1970.*

The main function of the tall chimney, 500 to 1000 ft or more in height, is to discharge combustion gases high in the atmosphere so that whatever particulates remain in the gases will be dispersed and gaseous pollutants diluted before reaching ground level. The shaft is the structural element of the chimney, designed to resist wind, temperature differentials, earthquake loads, and to shield the linear. The linear part of the chimney is the operational element, designed to resist chemical and physical actions of combustion gases, and to protect the shaft from them. Advantages and disadvantages of brick and steel for liner construction are considered. A brick liner costs much less than the steel liner. Above 600 ft the cost advantage of the steel liner increases rapidly. Design for gas velocity and wind loads is discussed, as well as chimney construction and effective height. Multiple use of chimneys is mentioned.

18008 APTIC NO. 37171

Carr, Wayne F.

HYDROCYCLONE. *(Assignee not given.) U. S. Pat. 3,568,847. 7p., March 9, 1971. 5 refs. (Appl. Dec. 9, 1968, 3 claims).*

Known hydrocylcones for cleaning cellulose suspensions and similar liquid slurries are relatively ineffective in removing foreign particles from mixtures avove 1% fiber consistency. In small separators, large particles are pulled into the higher angular velocity zones of the vortex; in large separators, such particles are forced to the cone wall and frequently held in a stationary orbiting field. By effecting changes in the transition point between the forced and free vortex, an improved cyclone for purifying wood pulp fibers controls the highest centrifugal force zone to achieve the desired particle separation. The cyclone consists of an upper inlet chamber for receiving suspensions and a lower inverted conical vortex chamber for receiving fluid from the upper chamber. A vortex finder in the inlet chamber induces a reversal of the downward flow of the accepted fraction of the suspension from the free vortex path in the lower chamber to an inner forced vortex path. An expandable diaphragm in the vortex finder varies the diameter of the flow path and shifts the transition zone between the free and forced vortex paths. The principles of this invention are equally adaptable to the separation of heavy components from gases. The term fluid includes both liquids and gases, and the term heavier components includes any components, solid or liquid or gas, dispersed in a base medium having a lower specific gravity than the heavier component.

18009 APTIC NO. 36854

Chamberlain, R. E. and C. E. Cairns

ANALYSIS OF RECOVERY UNIT OPERATION AND CONTROL. *Pulp Paper Mag. Can. (Quebec), 73(1):97-104, Jan. 1972. 14 refs. (Presented at the Canadian Pulp and Paper Assoc., Technical Section, Annual Meeting, 57th, Montreal, Canada, Jan. 26-29, 1971.)*

Tests were undertaken to evaluate the potential for improved instrumentation of recovery furnace operations and better control of both sulfur gas (hydrogen sulfide and sulfur dioxide) and particulate emissions. The testing considered all major operating variables in the recovery operation, their intermediate effects on furnace operation, and the final operating results. The tests indicated that additional secondary air will increase the oxidation of combustion products without increasing particulate carryover or tube deposition. Despite higher excess air, stack heat losses did not increase because existing temperature simultaneously increased. Change in primary air had no effect on black liquor reduction, except possibly on a short-term basis. Increased secondary air, however, lowered black liquor reduction. Particular attention should be paid to brightness as a measure of char-bed temperature and combustion stability. This measurement is a key to minimum sulfur gas emission and particulate carryover. Air consumption as an index of furnace combustion may provide a control base for increaced stabilization of recovery furnace temperatures. Although this concept is most easily implemented through computer control, modification of air control on an analog basis should reduce variation in furnace combustion. Establishing furnace production according to combustion and smelting rates suggests trimming the input solids rate to maintain the amount of the material in the furnace constant. (Author summary modified)

18010 APTIC NO. 36455

Coutant, R. W., R. E. Barrett, and E. H. Lougher

SO2 PICKUP BY LIMESTONE AND DOLOMITE PARTICLES IN FLUE GAS. *J. Eng. Power, vol. 92:113-122, April 1970. 7 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, Los Angeles, Calif., Nov. 16-20, 1969, Paper 69-WA/APC-1.)*

The reaction between sulfur dioxide and limestone and dolomite particles in flue gas was investigated by exposing the particles to flue gas in a dispersed-phase reactor that simulates localized boiler-furnace conditions. Variables included were residence time, temperature, particle size, SO2 concentration, and chemical state of the stone. A model is hypothesized for the SO2-particle reaction that is consistent with the experimental data. Sulfite formation is the primary mode of sulfur pickup during the early stages of the process, when the stone is relatively cool. In the later stages of the process, as the stone heats up to temperatures above the thermodynamic limit for sulfite existence (about 1400 F), the sulfite can calcine and SO2 is lost from the particles. Concurrent with these steps, the sulfite can be oxidized and/or disproportionated to form sulfate. The net result is a maximum in sulfur pickup during the first second of exposure in the reactor.

18011 APTIC NO. 36427

Debrun, G.

THE FIGHT AGAINST AIR POLLUTION FROM E.D.F. POWER STATIONS. *(Les problemes de prevention de la pollution atmospherique provoquee par less centrales thermiques E.D.F.). Text in French. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 87-89. (Oct. 4-7, Paper IV/3.)*

Work on the prevention of atmospheric pollution caused by the power stations of Electricity de France is reviewed. Control methods for emissions of solid and gaseous pollutants and dispersion of ground level combustion gases are examined. Research programs and future plans are discussed. The major emissions to be controlled include fly ash, smoke, sulfur oxides, and dusts.

18012 APTIC NO. 36174

Dejonghe, P., J. Pyck, and N. van de Voorde

DRY PURIFICATION OF INCINERATOR OFF-GASES. *(Epuration seche des gaz de combustion d incinerateur). Text in French. Commissariat a l Energie Atomique, Saclay (France), Centre d Etudes Nucleaires, Pollut. Radioact. Milieux Gazeux, Proc. Symp., Saclay, France, 1963, p. 301-308. 5 refs. (Nov. 12-16.)*

During operation of an incinerator for radioactive wastes, black smoke is formed, primarily while burning plastics or rubber. The black smoke, which is not cleared in a cyclone, coagulates on the prefilters and causes there an almost instantaneous plugging. In order to solve this problem, the gases were cleaned by filtration through different types of tissues by electrofiltration. For gases containing five g of humidity/cu m, it was possible to retain 93% of the carbon black in a double stage electrofilter. Thus, the lifetime of the tissue-filters was prolonged by a factor of 10. The flow rate through the electrofilter was between 0.4 and 1.0 m/sec.

18013 APTIC NO. 37174

Diamant, R. M. E.

THE PREVENTION OF POLLUTION. PART X -- AIR POLLUTION. *Heating and Ventilating Eng., 45(533):291-297, Dec. 1971. 13 refs.*

Although abatement costs will be high, air pollution can be reduced to very low levels even in densely populated and highly industrial countries. Methods available for reducing domestic pollution are use of smokeless fuels, use of gas-fired appliances and electric fires, desulfurization of domestic fuel oil, and district heating. By far the most effective method is to heat individual dwellings with hot water or steam supplied from central stations. These stations are oil or coal-fired boiler houses, power-generating plants with waste heat reclamation, refuse incinerators, or industrial sources of waste heat. All are large enough to justify exhaust gas-cleaning plants. With present-day technology, virtually all solid, liquid, and gaseous pollutants can be removed from industrial waste gases. The main techniques used are gravity settling chambers, inertial separators, cyclones, filtration plants electrical precipitation plants, and liquid scrubbing. The most effective of these are filtration, which removes particles as small as 20 nm in diameter, and electrostatic separation, which removes particles as small as 10 nm in diameter.

18014 APTIC NO. 36344

Dienemann, Paul F. and Armando M. Lago

AIR POLLUTION IMPACTS. *In: External Costs and Benefits Analyses, NECTP. Research Management Corp., Bethesda, Md., Dept. of Transportation Contract 7-35297, Rept. NECTP-224, p. 53-63, Dec. 1969. 10 refs.*

NTIS: PB 190944

The air pollution effects of alternative transportation systems for the Northeast Corridor were computed for the period 1975-1980. The systems include three high-speed, electric-powered surface modes (two rail modes and a tracked air cushion vehicle) and two new aircraft (VTOL and STOL). The surface systems will have a negligible effect in diverting automobile and diesel bus traffic and thus very little impact on carbon monoxide and hydrocarbon emissions. Power plants required to supply these systems will increase sulfur dioxide emissions by only small amounts. Similarly, increases in CO levels due to VTOL and STOL emissions will be negligible.

18015 APTIC NO. 36478

Dumon, R.

TREATMENT OF LIQUID EFFLUANTS IN A NEW ELF-HEURTY TYPE INCINERATOR. *(Traitement d effluents liquides dans un nouveau type d incinerateur Elf-Heurty). Text in French. Chim Ind., Genie Chim., 103(20), 2617-2618, Dec. 1970.*

Highly polluted liquid effluents are destroyed by the new Elf-Heurty type incinerator. In general, highly flammable combustibles are required that are needed in low quantities and are also cheap. Elf system emulsion burners are used for this incinerator. A mixture consisting of liquid dispersion and liquid combustible additive is atomized in the reaction chamber by compressed air. Strict temperature homogeneity is imperative for the whole reaction chamber. The advantages involved in this system lie in low demand for cheap combustibles, the absence of further pollution, the possibility to control furnace atmosphere (oxidizing or reducing), high reliability in operation, and in the utilization of the steam thus generated. The system can also be applied for liquids of high concentration. This incineration method can be used in chemical, petroleum, pharmaceutical, textile and paper-making industry, and in metallurgy. Various modifications can be introduced for treating various liquids.

18016 APTIC NO. 36173

Dyment, J.

THE PENETRATION OF FIBROUS MEDIA BY AEROSOLS AS A FUNCTION OF PARTICLE SIZE. *Commissariat a l Energie Atomique, Saclay (France), Centre d Etudes Nucleaires, Pollut. Radioact. Milieux Gazeux, Proc. Symp., Saclay, France, 1963, p. 395-403. 17 refs. (Nov. 12-16.)*

The accurate experimental determination of the penetration of fibrous filter media by aerosols is discussed as a function of particle size. A heterogeneous sodium chloride aerosol was sampled before and after passing through the glass fiber filter medium by an electrostatic precipitator, and the samples were examined under the electron microscope. The relation between particle size and penetration was derived at different gas velocities by comparison of the size distribution of the filtered and unfiltered clouds. Size analyses were made of plutonium aerosols occurring in glove boxes and enclosures during typical working conditions. (Author abstract modified)

18017 APTIC NO. 36395

Eyraud, C., J. Joubert, R. Morel, C. Henry, and B. Roumsey

A NEW DUST COLLECTOR USING ELECTROSTATICALLY SPRAYED WATER. *(Etude d un nouveau depoussiereur a pulverisation electrostatique d eau). Text in French. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr., Proc., London, England, 1966, p. 129-130. 14 refs. (Oct. 4-7, Paper V/5.)*

A new dust collector using electrostatically sprayed water is described. Design criteria and experimental results are included. Its efficiency was better than that of a standard precipitator for the same volume of gas treated, the same size of electrostatic field, and the same overall size of equipment. 0

18018 APTIC NO. 36526

Ferraiolo, G., A. Reverberi, G. Lodi, and M. Gaggero

INSTALLATION FOR THE WASHING OF INDUSTRIAL GASES. NOTE I INFLUENCE OF THE TYPE OF PACKING SURFACE ON THE FLOW DYNAMICS OF THE ABSORBER. *(Impianti per il lavaggio di gas industriali. Nota I-Influenza della superficiale del riempimento sul regime fluodinamico dell assorbitore). Text in Italian. Riv. Combust. (Milan), 25(9):397-403, Sept. 1971. 15 refs.*

The influence exerted by type of packing surface on hold-up, loading, and flooding conditions in a gas-washing plant was studied. A semi-commercial pilot plant was used for the investigations, the first results of which indicate that the surface characteristics of the packing represent a significant design variable -- especially for handling technico-economic optimization problems.

18019 APTIC NO. 36031

Ferris, Glenn K.

AIR POLLUTION CONTROL SYSTEMS. *Aust. Refrig., Air Cond., Heat., 25(1):18-28, Nov. 1971. 3 refs. (Presented at the Australian Institute of Refrigeration, Air Conditioning and Heating Conference, Perth, Australia, May 1971.)*

Air pollution control systems should be included as part of the original engineering when a new plant is being designed. An accurate feasibility study should indicate: basically what type of equipment is required to achieve the air quality stated in the regulation applicable to that particular industry and location; capital cost and, roughly, maintenance and operating costs; space, water, and power requirements; and rate of amortization where the recovered product is saleable. The assessment of problems and establishment of control design parameters are discussed. Low resistance cyclones, high resistance cyclones, low energy wet scrubbers, high energy wet scrubbers, fabric filters, and electrostatic precipitators are described for dust and fume collection. Explosive materials are classified according to rates of pressure rise, and explosion characteristics of various dusts are listed. Capital, operating, and maintenance costs are indicated.

18020 APTIC NO. 36184

Friedlander, Sheldon K., Leslie Silverman, Philip Drinker, and Melvin W. First

HANDBOOK ON AIR CLEANING PARTICULATE REMOVAL. *Harvard School of Public Health, Boston, Mass., Dept of Industrial Hygiene, 89p., 1952. 75 refs.*

Air cleaning methods for particulate removal and criteria for judging their effectiveness are presented. Various types of aerosols are defined, and the behavior of aerosols is considered. Two types of processes in the removal of particulate matter from air are distinguished. The first consists of preparing the particules for separation or conditioning by flocculating, wetting, or charging them; the second process is the actual separation of the conditioned particles from the gas. whether or not the particles are conditioned, in modern air cleaning equipment they move to the collecting point because of gravity, centrifugal or inertial forces, diffusion, electrical forces, and thermal forces. Settling chambers, cyclones, baffle chambers, scrubbers and other wet collectors, filters, and electrostatic precipitators are discussed. Air cleaners are rated in terms of cleaning efficiency, resistance, pressure loss, flow rate, velocity, and initial and operating costs.

18021 APTIC NO. 36507

Friend, G.

AMMONIA INJECTION FOR NEUTRALISING BOILER FUMES. *Mech. Chem. Eng. Trans., 7(2):55-60, Nov. 1971. 16 refs.*

Operating experience with a liquid ammonia injection system for control of toxic and corrosive fumes from an oil-fired boiler in a multi-story office building is described. The process of injecting ammonia into boiler flue gases was successfully applied through a masonry chimney inside the building. Subsequent tests showed that the ammonia injection system reduces corrosion of steel parts, the acidity of flue dust, and sulfur dioxide emissions. Operating costs of the injection system amount to only about $1/day.

18022 APTIC NO. 36369

Gabbert, W. L.

EQUIPMENT FOR THE COLLECTION OF FLY ASH, DUST, SOOT, AND SMOKE FROM THE FLUE-FED INCINERATOR. *Air Repair, 4(3):119-123, Nov. 1954.*

Several types of conventional gas cleaning equipment were applied to apartment building incinerator flue gases. Results showed that commercially available air cleaning equipment will remove the coarser solids causing public nuisance complaints (fly ash, dust, and soot) with high efficiency. The addition of low voltage, air filter type electrostatic precipitators with precleaning filters will remove practically all visible smoke, where the additional equipment and maintenance costs are justified. Condensation of grease vapors during cold operation must be considered in colder climates. Wet type collection equipment is not affected by such condensation, although plugging of fabric media is indicated unless expensive precautions are taken.

18023 APTIC NO. 36145

Gallopoulos, N. E.

PROJECTED LUBRICANT REQUIREMENTS OF ENGINES OPERATING WITH LEAD-FREE GASOLINE. *Preprint, Society of Automotive Engineers, Inc., New York, 9p., 1971. 47 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Montreal, Quebec, June 8-11, 1971, Paper 710585.)*

Changes in compression ratio, spark timing, exhaust gas recirculation, catalytic converters, crankcase and evaporative controls, modifications in air-fuel ratio, and emission controls in engines burning unleaded gasoline will reduce the concentration of nitrogen oxides in blowby gas, blowby gas flow rate, and reduce other emissions. With proper engine cooling systems, engine oil temperatures may not be affected. The consequences of these changes for engines using high quality (SE) oils at current drain intervals are virtual elimination of rust; reduction of sludge; no effect on wear and oil thickening; and possible worsening of varnish. Therefore, extension of the drain interval with SE engine oils may be possible, but final decisions will depend on research findings in the areas of engine wear and varnish and oil thickening. A desirable property of future oils is low metallic content. (Author abstract modified)

18024 APTIC NO. 36144

Giles, William

VALVE PROBLEMS WITH LEAD-FREE GASOLINE. *Preprint, Society of Automotive Engineers, Inc., New York, 9p., 1970. 7 refs. (Presented at the Society of Automotive Engineers, Mississippi Valley Section Meeting, Oct. 22, 1970, Paper 710368.)*

High exhaust valve recession rates were observed in light duty engines operating on lead-free gasoline. Recession proceeded 10-20 times faster than with leaded fuel, and occurred on the integral cylinder head sets. The reddish deposits covering recessed valves had a high iron concentration and a low zinc concentration. Adhesive wear was the most common type of wear phenomenon, and the only type present in all cases of surface contact. An equation developed for predicting volume of material lost through adhesive wear identifies the parameters which should be modified to reduce valve seat recession.

Engine tests showed valve seat angle and cylinder head seat hardness and/or structure are the most significant factors in reducing wear. Coatings, wide seats, and improved valve train stability by themselves are insufficient to stabilize wear rates. Wide seats, use of seat inserts, and lower seat angles resulted in shortened valve burning life in engines run with leaded gasoline. Induction-hardened cylinder head seats reduced wear with no effect on valve durability.

18025 APTIC NO. 36917

Granitzer, Helmut

THE COUPLING OF HEAT SUPPLY WITH POWER SUPPLY IN CITIES. *(Waerme- Kraftkoppelung in der staedtischen Energieversorgung). Text in German. Energie (Munich), 23(11):321-324, Nov. 1971.*

The efficiency of combining heat and power production is demonstrated by the example provided by the city of Klagenfurt in Austria. It makes remote heating more appealing to the consumer, since the cost becomes competitive with individual oil and coal-fired heaters. Of all apartments built in 1969, 17% received individual heaters, 43% own central heaters, and 40% were equipped with connections for remote heating. The growing concern about air pollution and the rising prices of coke and primarily fuel oil will, in the future, make the consumer turn even more to remote heating.

18026 APTIC NO. 36189

Grimm, Carlton D. and Lloyd Berg

HYDRODESULFURIZATION CATALYST SUPPORT MATERIALS. *Preprint, American Inst. of Chemical Engineers, New York, 20p., 1971. 4 refs. (Presented at the American Institute of Chemical Engineers National Meeting, 68th, Houston, Tex., Feb. 18-March 4, 1971, Paper 20d.)*

Alumina silica catalyst supports with random or uniform pore dimensions were studied for hydrodesulfurization properties. The supports covered a wide range of pore size and volume, alumina content, silica content, surface area, and density parameters. Cobalt and molybdenum were deposited on the supports in various combinations. The physical characteristics and basic chemical composition of the catalyst supports had more effect on hydrodesulfurization than the amount of cobalt or molybdenum added. Operating conditons and experimental results are included. (Author abstract modified)

18027 APTIC NO. 36220

Grunewald, Gerhard Wilfried and Gerhard Hochgesand

A PROCESS FOR REMOVING HYDROGEN SULPHIDE AND CARBON DIOXIDE FUEL GASES AND SYNTHESIS GASES CONTAINING THE SAME. *(Metallgesellschaft A.G., Frankfurt-am-Main (West Germany)) Brit. Pat. 1,196,658. 8p., July 1, 1970. (Appl. Oct. 3, 1967, 6 claims).*

A process is described for removing hydrogen sulfide and carbon dioxide from fuel gases and synthesis gas. The contaminated gas is passed under pressure through two absorption stages, in each of which the gas is contacted with an organic scrubbing liquid at a temperature below O C. The first absorption stage removes H2S; the second, CO2. Both stages provide for regenerating the scrubbing liquid by flashing and heating. These units for the re-absorption of gas components that have been dissolved and subsequently released by a reduction of pressure or partial pressure eliminate the disadvantages of previous methods. Suggested organic solvents include acetone, xylene, and toluene.

18028 APTIC NO. 37189

Hahnemann, Horst W.

CLEAN AIR WITH HOT WATER EJECTORS. *(Saubere Luft mit Heisswasserejektor). Text in German. Umwelt (Duesseldorf), 1(6):46, Dec./Jan. 1971. 1 ref.*

Hot water ejectors can be used for dust collection. The hot water from the ejector flows from a hot water generator, which is under pressure, through a nozzle, into a mixing pipe. At the exit from the nozzle an underpressure develops. Part of the water evaporates, while the remaining larger part is cooled, atomized finely, and accelerated. The jet which has a high specific weight due to the high liquid water content of 65 to 80% draws on ambient air, gas, or vapors, mixes with them, and accelerates the medium in the mixing tube. The mixing tube extends into a diffuser where during delayed flow the pressure increases again so that the ejector operates as a continuous pump. In a subsequent cyclone the gaseous, vaporous, and liquid phases can be separated again. The dust particles are contained in the drawn on gas agglomerate and can be separated in the cyclone. Several such hot water ejectors are in operation.

18029 APTIC NO. 36339

Harvey, Richard D.

PETROGRAPHIC AND MINERALOGICAL CHARACTERISTICS OF CARBONATE ROCKS RELATED TO SORPTION OF SULFUR OXIDES IN FLUE GASES. *Illinois State Geol. Surv., Environ. Geol. Notes, no. 38, 31p., Oct. 1970. 8 refs.*

Detailed petrographic, mineralogical, and chemical analyses of ten types of carbonate rocks were made and compared with their relative capacity for sorption of sulfur dioxide. Two limestones (one coarse-grained and one fine-grained), two calcite spars (one Iceland spar and the other bearing numerous crystal imperfections), an oolitic aragonite sand, four dolomites (a reef, a nonreef, one rich in limonite, and one rich in strontianite), and a magnesite were studied and tested. The imperfect calcite spar sorbed twice as much SO2 as the Iceland spar calcite. The oolitic aragonite sorbed the most and the magnesite the least SO2 of all the samples tested. The temperature of the test, 1800 F, may have been too high for maximum sorptive capacity of the magnesite. Linear regression analyses of the test data show that as the log of the sodium content increases the SO2 sorption increases. Certain petrographic parameters show correlations with the sorption. The SO2 sorption capacity of the limestones, dolomites, and calcite samples increases with the volume of pores greater than 1 micron in diameter. For all the samples except magnesite, the SO2 sorption capacity generally increases with decreasing mean grain size. The significance of these criteria for SO2 sorption will be further evaluated. (Author abstract)

18030 APTIC NO. 36413

Hasenclever, D.

THE USE OF RADIOACTIVE INDICATOR SUBSTANCES FOR SOLVING DUST PROBLEMS. *(Die Verwendung von radioaktiven Indikatorstoffen zur Loesung von Staubfragen.) Staub (Duesseldorf), 16(44): 159-173, 1956. 6 refs. Translated from German by William H. Everhardy, National Institutes of Health, Bethesda, Md., Translating Unit, 25p., July 30, 1958.*

A method which makes it possible to tag and characterize very fine particles of suspended matter by apposition of the atomic secondary products of a radioactive gas was described. The experimental procedure for radioactive filter testing were also described and the results obtained were compared with those obtained in the testing of a mixture of quartz dust and air. New formulas are given for the calculation of the radioactive degree of removal; with these, the measurement of crude and pure air in the experimental procedure can be avoided. Autoradiographs of different filter materials give information concerning the structure and composition of the filters. Autoradiographs of thermal-precipitator samples were taken from a mixture of the thorium emanation. They show that the thermal precipitator removes 100% of the radioactively tagged particles of suspended matter, that the precipitation begins in front of the heated filament, and by comparison with microscopic examinations in the bright and dark field, that the maximum granule size of the particles must be less than 0.2 micron. The konimeter is capable of holding back a considerable part of this suspended matter. (Author summary modified)

18031 APTIC NO. 36301

Hayashi, Hiroshi and Iwao Nemoto

STUDIES ON PERFORMANCE TEST METHOD FOR EXHAUST GAS TREATMENT CATALYST REACTOR (REPORT 3), EXAMINATION OF CONDITIONS FOR CATALYST ACTIVITY TEST. *(Haiki joka shokubai riakuta seino shikenho no kenkyu (daisanpo), shokubai kassei shiken joken no kento). Text in Japanese. Preprint, Japan Automobile Technical Assoc., Tokyo, p. 135-144, 1971. 9 refs. (Presented at the Japan Automobile Technical Association, Academic Lecture Meeting, Tokyo, Japan, 1971.)*

Test conditions for determination of catalyst activity performance for automobile exhaust gas purification were examined. Operating variables and parameters were examined with regard to the velocity of sample gas, the location of the catalyst, and composition of the sample gas. The previously used test apparatus with modifications was used for the tests, and eight American-made and seven Japanese-made catalysts were employed. The 1972 U. S. government standards of 1370 sec 18 mode operation patterns were used as references in determining the flow velocity and catalyst location effects. The standards were set on the calculation of the amount of exhaust gas at the average speed of 36 km/h, and at the maximum speed of 91 km/h. The amount of catalyst was determined by the engine s swept volume, PS two percent and PS three percent. The capacity of catalyst was determined by the comparison of light-on temperatures, reaction saturation temperatures, and the final reaction rate. The depth of the catalyst layer had no effect on the reaction rate, and any thickness more than four cm resulted in the same amount of catalytic action. Steam vapor harmed metal oxidation catalyst considerably, though temporarily, but carbon dioxide had no similar effect. The catalyst s capacity, especially a metallic oxidation catalyst s final reaction rate, varied greatly depending on the multiplication of the concentration of carbon monoxide and oxygen.

18032 APTIC NO. 36516

Hayes, C. T.

CUT INDUSTRIAL POLLUTION BY ELIMINATING GASEOUS WASTE. *Automation (Cleveland), 18(3):64-65, March 1971.*

Combustible gaseous contaminants are effectively disposed of by either direct flame or catalytic oxidation. The incineration system used depends on the nature of the fume to be treated, its combustible content, and whether there are inorganic materials or catalyst poisons present in the process. Generally, a catalytic unit can be operated at a discharge temperature of 900-1000 F, but temperatures of 1200-1400 F are required for straight flame incineration. Initial and operating costs of incineration are direct functions of the volume of air exhausted and solvent concentration. Efficiency of either a catalytic or thermal system is a function of discharge temperature. Methods of reducing exhausted air, increasing solvent concentration, and controlling discharge temperatures are indicated.

18033 APTIC NO. 36138

Haynes, C. D.

ATMOSPHERIC POLLUTION FROM PETROL ENGINES. CONTROL OF OXIDES OF NITROGEN BY EXHAUST RECIRCULATION. *Motor Industry Research Association, Nuneaton (England), Rept. 1969/12, 19p., May 1969. 6 refs.*

A 2500-lb car with a 1725-cc engine, pre-treated by engine tuning to reduce carbon monoxide and hydrocarbons, a simple system which automatically recirculated about 16% of the exhaust gas reduced nitric oxide by about 80% and gave emission levels within the proposed 1974 limits for California (1.3 gm/mile). The car also met the proposed 1974 limits for CO and HC. The system gave no significant short-term deterioration of driveability, fuel consumption, or cold-start performance. Ignition retard, increased exhaust back-pressure, and use of an aluminum cylinder head all gave minor reductions of NO. The most marked reduction was from ignition retard and the disconnection of the normal advance mechanism was sufficient to bring NO emissions down to the proposed 1972 limits for California (3 gm/mile). (Author conclusions modified)

18034 APTIC NO. 36075

Heinsohn, Robert J. and Philip M. Becker

FLAMES, IONS, AND ELECTRIC FIELDS. *Preprint, American Society of Mechanical Engineers, New York, 16p., 1970. 110 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, New York, Nov. 29-Dec. 3, 1970, Paper 70-WA/Fu-4.)*

A flame contains positive and negative ions and electrons arising from the complex chemical kinetics of combustion. Electric fields can selectively act upon the ions, bringing about large-scale changes in the flame. The motion of ions induces motion of the neutral gas in and near the flame. Inside the flame, the motion alters the rates of certain reactions in the kinetic mechanisms and may bring about changes in the overall reaction. Outside the flame, the motion alters the shape and entrainment capacity of flames. The luminosity, heat transfer, exinction, speed, and geometry of flames are significantly affected. Preliminary experiments indicate that nitrogen dioxide concentrations are reduced in premixed flat flames subjected to fields opposite to the direction of flow. Other potential applications for electric fields include noise generation and suppression and control of solid propellant burning. (Author conclusions modified)

18035 APTIC NO. 36869

Hemmingson, Myron E.

CHIMNEY ASPIRATOR. *(Assignee not given ) U. S. Pat. 3,570,423. 4p., March 16, 1971. 7 refs. (Appl. April 9, 1969, 1 claim).*

By insulating that portion of a chimney projecting outward from a building, it is possible to maintain the temperature of the burned gases and thus avoid the condensation of vaporized fat or grease from restaurant stoves which tends to settle or deposit on the walls of the chimney. A housing or jacket, having inlet and outlet ports, is connected loosely to the exhaust end of the chimney. A motor driven fan communicates with the housing inlet port to drive through the ambient air and generate a venturi effect around the exhaust opening of the chimney. Unlike previous draft inducing devices, the present apparatus can be installed with existing chimneys at a relatively low cost.

18036 APTIC NO. 36356

Hervert, George Ladislav

APPARATUS FOR REDUCING EVAPORATIVE LOSSES FROM AN ENGINE CARBURETOR. *(Universal Oil Products Co., Des Plaines, Ill.) Brit. Pat. 1,203,725. 4p., Sept. 3, 1970. (Appl. Jan. 25, 1968, 9 claims).*

Air pollution caused by gasoline losses from carburetor bowl internal vents is eliminated by providing a hydrocarbon vapor adsorption bed in combination with a carburetor system; the bed will sorb vapors from the vent during slow engine speed operations and hot soak periods, but will permit hydrocarbon release from the adsorbent bed back into the carburetor by the increased air flow associated with subsequent high engine speed operations. The engine carburetor system has an air-fuel mixing section, a float bowl assembly, and a fuel inlet extending from the float bowl assembly to the mixing section. An air inlet and passageway extend to the mixing section upstream of the fuel inlet, and an internal vent channel extends from the float bowl to the air passageway at a point upstream from the mixing section and downstream from the air inlet. The permeable hydrocarbon vapor absorbent can absorb hydrocarbon vapors during slow engine speed operation and engine hot soak periods, and can desorb hydrocarbon vapors during increased air flow into the carburetor. The absorbent is dispersed transversely across the air passageway at a point between the internal vent and air inlet.

18037 APTIC NO. 36880

Hirai, Yoshimi, Shinichi Yamamoto, and Norio Morimoto

AFTERBURNER TYPE EXHAUST PURIFICATION APPARATUS. *(Afutabanashiki haiki joka sochi). Text in Japanese. (Daihatsu Engineering Co., Osaka (Japan)) Japan. Pat. Sho 46-40045. 3p., Nov. 26, 1971. (Appl. March 31, 1969, 1 claim).*

In order to prevent the damage caused by the drastic rise of temperature of an afterburner on a fragile ceramic-made heat exchanger and in passage walls, a pre-combustion chamber was invented. When the high temperature flame of afterburner touches the ceramic parts of normal temperature (15-30 C), the impact often creates cracks. The distributor for the afterburner can spark either to the precombustion room or to the afterburner. The exhaust pipe leads exhaust gas from the engine, and enters the precombustion room through a flame stabilizer. After the temperature in the precombustion room rises to 650 C (approximately 5.5 min), the distributor of the precombustion room is switched over to the afterburner ignition. The switch control may be a choke valve or a bimetallic temperature operation. The preheated gas, which is lower than the high temperature flame, has already heated the heat exchanger and the passage walls to the afterburner, and the impact of the ignition in the main combustion room of the afterburner will not damage the ceramic.

18038 APTIC NO. 36431

Holl, R. E.

CONTROL OF ATMOSPHERIC POLLUTION ON EXISTING AND FUTURE SITES OF E.D.F. POWER STATIONS. *(Controles de la pollution atmospherique sur les sites des centrales thermiques E.D.F. actuelles et futures). Text in French. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 84-86. (Oct. 4-7, Paper IV/2.)*

Control methods in use at power plants of Electricite de France are reviewed with respect to equipment used, efficiency, research programs, and effective results. The effects of power station emissions on the environment were determined and critical periods were established for the burning of special fuels. Studies on deposited dusts, acid content of the atmosphere, and black smoke are examined.

18039 APTIC NO. 36350

Holland, Jack

ELECTRIC SHUTDOWN INSTRUMENT SYSTEMS FOR GAS ENGINE OPERATED Equipment. *Preprint, Inst. of Electrical and Electronics Engineers, New York, 7p., 1970. (Presented at the Institute of Electrical and Electronics Engineers, Petroleum and Chemical Industry Conference, Annual, 17th, Tulsa, Oka., Sept. 14-17, 1970, Paper PCI-70-21.)*

The operation of electric instrument systems for gas engine-operated equipment poses unique problems for the natural gas industry. The equipment is usually located where Commercial power is unavailable or undesirable for operating protective shutdown systems. In addition, ambient atmospheres surrounding the gas engines are hazardous and can contain corrosive agents such as hydrogen sulfide. Magneto-powered DC power supplies for shutdown systems have obvious reliability advantages and are widely used in coastal areas and locations where H2S is part of the gas stream. The use of discreet switch currents offers sensor switch designers considerable latitude in the selection of components to reduce sensor size, cost, and performance.

18040 APTIC NO. 36324

Holm-Jensen, Ib

MERCURY VAPOUR ABSORBING PAINT. *Acta Pharmacol. Toxicol. (Copenhagen), vol. 7:201-219, 1951. 5 refs.*

The experimental development of a paint capable of absorbing mercury vapor from the air was described. The experiments were carried out in a microscale using radioactive mercury, Hg 203. Mercury analyses were carried out with a Geiger-Mueller counter. The mercury absorbing power of the substance under investigation was compared with that of gold. Substances tested were base metals, organic compounds containing free sulfur hydrogen-groups, pure sulfur, and metal sulfides. The active agent in the resulting paint was zinc sulfide, which is able to absorb mercury vapor at a rate comparable with that of iodized charcoal. Different factors influencing the uptake of mercury vapor in zinc sulfide were investigated. The best preparations of zinc sulfide are precipitated from a solution of zinc sulfate containing 0.1 M/l of sulfuric acid. The rate of uptake of mercury vapor in all zinc sulfide preparations is accelerated by illumination.

18041 APTIC NO. 36280

Horn, Jack aad James L. Warner, Jr.

FUME ABATER CONVERTS WASTE TO USEFUL ENERGY. *Plant Eng., 26(2):34-35, Jan. 27, 1972.*

A catalytic fume abater that incinerates a low concentration of ethylene in a relatively cool gas emission is described. The principal advantage of the system is that the catalytic reaction takes place at fairly constant heat levels. By using the energy released when the ethylene is burned, Union Carbide saves on the operating costs of the equipment. Catalyst-coated elements are stacked to make two walls within the reactor chamber, creating a funnel-like core. The catalytic elements or carriers are clusters of porcelain rods coated with active and long-lasting combinations of alumina and platinum. A preheater, control valves governed by thermocouples, a combustion chamber, and an aftercooler heat exchanger are utilized in the system.

18042 APTIC NO. 36437

Huenigen, E., N. Jaskulla, and K. Wettig

THE REDUCTION OF CARCINOGENIC CONTAMINANTS IN EXHAUST GASES OF PETROL ENGINES THROUGH FUEL ADDITIVES AND CHOICE OF LUBRICANTS. *(Die Herabsetzung krebsfoerdernder Schadstoffe in Ottomotoren-Abgasen durch Kraftstoffzusaetze und Schmierstoffauswahl). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 191-193. 5 refs. (Oct. 4-7, Paper VI/12.)*

The effect of fuel additives and lubricants on carcinogenic pollutants in exhaust gases from petrol engines was investigated. Data analyses and measurements determined the test conditions, since comparisons of benzo(3-4)pyrene were valid only under clearly defined criteria of temperature and sampling procedures. Fuel additives decreased the benzo(3-4)pyrene content in the exhaust gases to practically zero; the same effect was evident at the beginning if the amount of lubricating oil was reduced, but was barely evident if the ratio was less than one to 40. The inability to separate the substance from the carrier proved an obstacle to further investigations.

18043 APTIC NO. 36170

Hunyady, Istvan and Karoly Koller

PROCESS FOR THE DESULFURIZATION OF INDUSTRIAL GASES IN CLOSED CYCLE WITH SIMULTANEOUS EXTRACTION OF PURE SULFUR. *(Eljaras ipari gazoknak korfolyamatban, tiszta ken egyideju kinyerese melletti kentelenitesere). Text in Hungarian. (Assignee not given.) Hung. Pat. 102324. 2p., April 15, 1931. (Appl. Aug. 24, 1928, 1 claim).*

A process for the effective desulfurization of industrial gases in a closed cycle is discussed where the sulfur is bound very rapidly and can be regenerated at low cost and can be produced without acid formation. The gases to be cleaned are brought into intimate contact with an aqueous suspension of fine pulverized manganese oxide which decomposes the hydrogen sulfide contained in the gases with simultaneous separation of sulfur and formation of manganous sulfide. The watery mixture of sulfur and manganous sulfide is filtered, and the wet filtration residue is then exposed to air where the manganous sulfide forms manganous hydroxide with simultaneous sulfur separation. The wet manganous hydroxide containing sulfur is then dried by hot, dry air while the manganous hydroxide is transformed into manganese oxide. The sulfur is extracted from this mass by solvents such as trichloroethylene, and the manganese oxide residue is recycled into the gas cleaning process.

18044 APTIC NO. 36908

Ikegaya, H.

AIR POLLUTION BY FERRO ALLOY OPEN TYPE ELECTRIC FURNACE. *(Gokintetsuyo kaiho gata denkiro no taiki osen ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):188, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The multiple dust collector system for multiple open electric furnaces is illustrated with a diagram. The top of the stack is closed, and a common duct connected to the multiple dust collector system is attached to the lower part of each stack. The flow amount of exhaust is controlled by regulator-valves attached to each furnace, which is monitored by TV at a central control room. The advantages of this multiple system is that synthetic fibers and glass fibers can be used as filters, and that the furnace can be operated without reducing the productivity while taking the measure for air pollution prevention.

18045 APTIC NO. 36117

Inculet, I. I. and D. R. Topping

ELECTROSTATIC CHARGING AND DISSIPATION OF DUST CLOUDS IN ENCLOSED ROOMS. *Inst. of Electrical and Electronic Engineers, New York IEEE (Inst. Elec. Electron. Engrs.) Ind. Gen. Appl. Group, 5th Conf. Rec., Chicago, Ill., 1970, p. 267-272. 6 refs. (Oct. 5-8, Paper ES-3.)*

Experimental results are presented on a method of cleaning the particles in suspension in the air of a working area, without circulating the air. Only a small percentage of the particles are charged directly by means of a light carriage supporting a grid of alternate corona and ground potential wires and travelling back and forth through the smoke and dust cloud. One pass of the carriage electrified the particles in 2.2% of the total volume of air (0.35 cu m in an experimental room of 15.6 cu m volume) at speeds up to 1.8 m/sec. Subsequent to the electric charging of the partial volume, the entire cloud of particulates was left to dissipate either by itself or under the influence of an electric field. Starting with smoke and normal ambient dust concentrations in the order of 800 million particles (equal to or greater than 0.15 micron diameter) per cu m, dissipations of 30 to 90% of all particles took place within 25 min after 4 to 60 sec travelling time (1-20 passes) of the charging carriage. Possible application of the method is envisaged for large foundries of workshops where fast moving of the air masses would generate more dust than the amount cleaned by a filtering system. (Author abstract modified)

18046 APTIC NO. 36827

Ireland F. E.

DETERMINING THE HEIGHT OF CHIMNEYS IN GREAT BRITAIN. *(Bepaling van de schoorsteenhoogte in England). Text in Dutch. Polytech. Tijdschr., Ed. Procestechniek (The Hague), 26(25):980-985, 1971. 9 refs.*

The determination of the chimney height according to the Clean Air Act (1956) and Alkali and Co. Works Regulation Act (1906) is described. The Clean Air Act (1968) requires that the proposed height of a chimney be accepted by the municipal authorities within four weeks of the date of application. Otherwise it is assumed that the proposal is accepted. The original Alkali Act (1803) dealt with the first stage of the Leblanc Process for the production of alkali or sodium carbonate. Later regulations included the production methods of numerous other industries. A number of mathematical and empirical formulas are available in the literature to calculate the acceptable chimney height. Due to the complexity of the actual phenomenon, a simplified formula with its assumptions is not very accurate. Sulfur dioxide is used in some formulas as representative of all the dangerous gases or mixtures of gases. The other parameters are meteorological circumstances such as wind speed, topography, micrometeorology, and location of a given chimney. Two phases of the calculation based on empirical formulas are recommended. In the first phase, an uncorrected chimney height is calculated. In the second phase, a correlation is applied. A table of emissions and chimney heights is included based on the above procedure.

18047 APTIC NO. 36302

Jones, James H. and Ervin E. Weaver

PROCESS FOR EXHAUST GAS CLEANING. *(Verfahren zum Reinigen von Abgasen). Text in German. Ford Motor Co., Cologne (West Germany)) W. Ger. Pat. 2,046,180. 18p., June 9, 1971. (Appl. Sept. 18, 1970, 4 claims).*

A process for a considerable reduction of carbon monoxide, unburned hydrocarbons, and nitrogen oxides contained in the exhaust gases of internal combustion engines is discussed. The engine is operated at an air-fuel ratio adjusted to a value not considerably lower than the stoichiometric, so that unacceptable high concentrations of nitrogen oxides are formed in the exhaust blast which latter is directly led from the engine to a catalytic converter to decompose an important fraction of the carbon monoxide and unburned hydrocarbons at high temperature. The exhaust gas with lowered concentrations of carbon monoxide and unburned hydrocarbons is cooled to a temperature not much higher than 480 C, and ammonia is added to the cooled gas in an amount required to decompose a major proportion of the nitrogen oxides in spite of oxygen being present. The cooled exhaust blast containing ammonia is then led through a catalyst suitable for initiating the reaction of ammonia to nitrogen oxides, producing water and nitrogen without disturbing effects. The ammonia applied is replaced partially by ammonium carbonate, urea, hexamethylenetetramine, hydrazine, or ethylene diamine. Catalysts on copper oxide or noble metal basis are used.

18048 APTIC NO. 36866

Kandell, Paul and George Nemes

METHOD OF REMOVING NITROGEN OXIDES FROM GASES. *(Grace (W. R.) and Co., New York) U. S. Pat. 3,567,367. 3p., March 2, 1971. 3 refs. (Appl. Aug. 20, 1968, 5 claims).*

In the conventional nitric acid process, ammonia is oxidized over a platinum-rhodium gauze catalyst to form nitrogen oxides which are absorbed into water, producing nitric acid. Spent gas from the top of the absorber tower, commonly called tail-gas, contains a small residual percentage of nitric oxide, nitrogen dioxide, nitrogen, water vapor, and some free oxygen. Most plants employ tail-gas combustors or abators wherein the residual nitrogen oxides are converted in the presence of fuel gas over a catalyst to nitric oxide and are thence reduced to nitrogen. In the present method, water is added to the tail-gas prior to and after final reduction in order to give increased reduction, longer catalyst life, and increased energy available for recovery in the treated effluent. (Author abstract modified)

18049 APTIC NO. 36472

Kato, Seitaro, Heiichiro Tohata, and Toshiaki Fujii

CATALYTIC COMBUSTION OF HYDROCARBON VAPORS. *(Yuki yozai joki no shokubai sankaho ni yoru jokyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):175, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-19, 1971.)*

Catalytic oxidation under optimum conditions is one of the most effective and economical method for the removal of hydrocarbons from effluent gas. Experiments were carried out using platinum, cobalt, copper, and nickel catalysts by varying the flow rate and reaction temperature. Samples collected at the inlet and outlet of the reaction tube were analyzed by gas chromatography. Since the oxidation rate of multi-component hydrocarbons is determined by the least reactive benzene, the result was evaluated with respect to benzene. The effect of reaction temperature and concentration of pollutant on the rate of oxidation were also investigated.

18050 APTIC NO. 36871

Kiziauskas, Kazimieras

FUEL TANK VAPOR RECOVERY CONTROL. *(Ford Motor Co., Dearborn, Mich.) U. S. Pat. 3,572,659. 4p., March 30, 1971. 4 refs. (Appl. Sept. 3, 1968, 7 claims).*

From an anti-smog standpoint, it is desirable that fuel vapors emitted from a motor vehicle gas tank during a hot soak cycle not be freely ejected into the atmosphere, but be passed into the intake manifold of the engine to be subsequently burned. However, in the absence of additional air, such a large quantity of fuel supplied directly to the carburetor or intake manifold generally will not burn properly. A valve is described to be located in the lines between the fuel tank and the engine intake manifold for proportioning the amount of air to be mixed with the fuel vapors forced into the manifold. As a result, the overall carburetor fuel-air ratio is unaffected by the addition of vaporized fuel from the fuel tank. A vacuum override is provided to shut the valve and prevent excessive idle speed rpm increase.

18051 APTIC NO. 36424

Knott, D. R. J.

THE HEENAN AEROPUR ELECTRO-FILTER. *Public Cleansing (London), 60(6):274-276, June 1970.*

The Aeropur Electro-Filter, designed by Redman Heenan Froude Ltd., operates upon the principle of electrostatic precipitation and incorporates a system of irrigated particle removal. For gas temperatures higher than 400 C, a prior gas cooler can be incorporated to reduce temperature by spray injection. This additional water vapor in the gas leads to agglomeration of the dust particle content, increases electrical conductivity, and assists reaction between aggressive gas constituents.

18052 APTIC NO. 36298

Kobayashi, Shigehiko, Kazuhide Miyazaki, and Michiaki Yamamoto

METHOD AND CATALYST FOR THE PURIFICATION OF WASTE GAS CONTAINING CARBON MONOXIDE. *(Verfahren zum Reinigen von Kohlenmonoxyd enthaltenden Abgasen und Katalysator zu ihrer Reinigung). Text in German. Mitsui Mining and Smelting Co., Ltd., Tokyo (Japan)) W. Ger. Pat. 2,034,053. 24p., July 15, 1971. (Appl. July 9, 1970, 13 claims).*

Carbon monoxide can be oxidized from automobile exhaust gases or waste gases from other sources by a catalyst which contains manganese oxides and lead oxides within a range of ratios from 10:90 to 90:10, preferably in a 50:50 ratio, to which a third component is added which can be an oxide of alkaline earth or of rare earth elements, silicon dioxide, aluminum oxide, or metallic aluminum, copper, or iron. This catalyst containing a third component oxidizes a thousand times the quantity of CO corresponding to the chemical equivalent of the active components forming the catalyst in difference to an only 100-fold quantity of CO oxidized by a two component manganese-lead catalyst. To withstand high temperatures exceeding 500 C tablets are made from the components in powder form kneaded to a dough by aqueous solutions of salts of manganese or lead to which a ceramic bonding agent is added. The catalyst can also be produced by coating a latticed carrier of aluminum, copper, or iron with the catalytic mass.

18053 APTIC NO. 36393

Koehler, W.

METHODS FOR THE ABATEMENT OF AIR POLLUTION CAUSED BY CEMENT PLANTS. *(Verfahren zur Verminderung der durch die Zementindustrien Verursachten Luftverunreinigungen). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 114-116. 3 refs. (Oct. 4-7, Paper IV/12.)*

Control methods for emissions from cement plants are examined with respect to operating variables of temperature, contents, and dust components, processes involved, and efficiency of control techniques. Control methods include centrifugal dust extractors, fabric filters, gravel-bed filters, and electric dust extractors.

18054 APTIC NO. 36467

Kondo, Eiichi

ODOR CONTROL OF ACRYLIC ESTERS. *(Akuriru san esuteru no shuki taisaku ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):180, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Among more than ten acrylic esters manufactured, methyl acrylate (MA) and ethyl acrylate (EA) were presumed to be the source of bad odors. The odor intensity measured by the panel method according to the Association for Testing and Materials was MA 600 ppb and EA 60 ppb at the location 6.0 km from the source. To determine the rate of vaporization, an empirical formula was derived as a function of vapor pressure and wind speed. As control measures, careful sealing to prevent leakage and treatment of effluent gases by the adsorption method or chemical decomposition method were applied. Then the atmospheric concentrations of MA and EA in the surrounding area were reduced to levels below 1.0 ppb.

18055 APTIC NO. 36074

Lang, Robert J.

A WELL-MIXED THERMAL REACTOR SYSTEM FOR AUTOMOTIVE EMISSION CONTROL. *Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1971. 5 refs. (Presented at the Society of Automotive Engineers, International Mid-Year Meeting, Montreal, Canada, June 7-11, 1971, Paper 710608.)*

An experimental well-mixed thermal reactor system called RAM (Rapid Action Manifold) was devised, tested, and applied to several different size research vehicles. Low emissions were obtained because of the thorough mixing and quick warm-up of the system which was aided by flame-holders. The study indicates that the RAM concept represents a significant improvement over previously proposed thermal reactor systems. Two versions of RAM were studied. One was operated fuel-rich to minimize nitrogen oxides at the expense of fuel economy; the other was operated leaner and gave better fuel economy but less NOx control. The best emission results obtained were 3.7 g/mile carbon monoxide, 0.08 hydrocarbons, and 0.72 NOx. The fuel economy debit was in the range of 17-22%. Better fuel economy, in the range of 10-17% debit, was obtained at NOx levels of 1.9 g/mile. Driveability was good; durability was not tested. (Author abstract modified)

18056 APTIC NO. 36913

Langness, Purden S.

AIR CLEANER FOR INTERNAL COMBUSTION ENGINE. *(Dustmaster Corp., Harvey, N. Dak.) U. S. Pat. 3,566,586. 4p., March 2, 1971. 6 refs. (Appl. June 9, 1969, 1 claim).*

A new and improved air cleaner for a motor vehicle is described which comprises a cylindrical housing with an annular louvered inlet passage and a central passage, a deflector plate overlying the central passage, a tangential outlet passage through the deflector plate adjacent its periphery, and an outlet passage whereby contaminants in the air stream are centrifuged and exhausted. The deflector plate is so designed that contaminants which may become deposited on its upper surface will be picked up by the air stream and exhausted to the atmosphere, rather than being permitted to accumulate, as in previous devices. (Author abstract modified)

18057 APTIC NO. 36081

Lindsay, R., A. Thomas, J. A. Woodworth, and E. G. Zeschmann

INFLUENCE OF HOMOGENEOUS CHARGE ON THE EXHAUST EMISSIONS OF HYDROCARBONS, CARBON MONOXIDE, AND NITRIC OXIDE FROM A MULTICYLINDER ENGINE. *Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1971. 23 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Montreal, Quebec, June 7-11, 1971, Paper 710588.)*

A fuel-air mixture generator has been developed which allows a vehicle to be run on a chassis dynamometer under both transient and steady-state conditions on premixed homogeneous gasoline-air mixtures using conventional nonleaded gasoline. Under these conditions, cylinder-to-cylinder variations of air/fuel ratio and of carbon monoxide emission from a 90-cu inch four-cylinder engine were virtually eliminated, and variations of nitric oxide emissions were greatly reduced. However, variations in hydrocarbon emission were scarcely affected. With the premixed charge the vehicle could be run on an extremely lead air/fuel mixture, while retaining good driveability. At an air/fuel ratio of 22.5/1, CO and NO emissions over the U.S. Federal cycle according to the 1970 test procedure were 2.7 and 0.4 g/mile, respectively. However, unburned hydrocarbon emissions exceeded current legislative requirements. (Author abstract)

18058 APTIC NO. 37195

Matsumoto, Kiyoshi

PRESENT STATE OF COUNTERMEASURE FOR EXHAUST GAS FROM GASOLINE ENGINES. *(Gasorin kikan ni okeru haishutsu gasu taisaku no genjo). Text in Japanese. Preprint, Japan Society of Mechanical Engineering, Tokyo, 13p., 1971. 9 refs. (Presented at the Seminar on Environmental Pollution by Internal Combustion Engine and its Countermeasure, Tokyo, Japan, Nov. 29-30, 1971.)*

Automotive exhaust emission standards and studies made in the United States and Europe are reviewed; the countermeasures in Japan are discussed. Since the lead pollution episode in Tokyo in May 1970, lead additives in gasoline have become an object of study. Complete omission of lead from gasoline is scheduled to be legalized in April 1974. However, by subsequent investigation, it became clear that non-lead gasoline caused problems of valve recession, wearing the valve seat severely. Research is being conducted for developing an engine that can use non-lead gasoline and for additives that can replace lead. Already lead additives in gasoline 0have been reduced to 0.7 0.9 g/gal in premium gasoline and to 0.5 g/gal in regular gasoline. Inprovements are being made on cars by attaching idle limiters, in carburetion in the intake manifold, in thermostatic air cleaners, and fuel jet engines. For control of hydrocarbons, improvements are being made on the shape of the combustion chamber by reducing surface/volume ratio and increasing stroke/bore ratio, or preventing knocking. Some other improvements that have been suggested are delay of spark timing, increased of air supply at the time of idling, use of a throttle positioner or opener, use of a dash pot, or decrease of the fuel supply in case of a fuel injection engine. In order to control the amount of nitric oxide emissions, lowering the compression ratio, delaying ignition time, enlarging the valve overlap, using a lower air/fuel ratio, or suction of inactive gas or water are suggested.

18059 APTIC NO. 36239

Maximov, V. F., V. A. Bushmelev, and N. M. Isaeva

CHEMISORPTION OF HYDROGEN SULFIDE AND SULFUR DIOXIDE BY A WEAK ALKALINE SOLUTION IN A TURBULENT APPARATUS. *(Khemosorbtsiya serovodorodai sernistogo angidrida slabym belym shchelokom v turbulentnom apparate). Text in Russian. Tr. Leningr. Tekhnol. Inst. Tsellyul.-Bum. Prom., vol. 18:80-85, 1965. 2 refs.*

The purification of effluents from a soda-regenerating plant, which contain sulfur dioxide and hydrogen sulfide was investigated. A high efficiency of chemisorption of gases containing sulfur was achieved in a turbulent venturi apparatus with a wetting solution of sodium hydroxide, sodium sulfide, sodium carbonate, and sodium sulfate. Efficiency of chemisorption was directly proportional to the length of the nozzle of the venturi apparatus and to specific consumption of the alkaline wetting solution. Efficiency of chemisorption depended parabolically on the linear velocity of gas in a nozzle. At a velocity of 55-80 m/sec, the efficiency was maximum. The optimum conditions of operation of a venturi apparatus at 1:d equal to two (ratio of length and diameter of nozzle) in the purification of effluents were: velocity of gas in nozzle 60-70 m/sec, specific consumption of wetting solution one l/cu m, and efficiency of H2S and SO2 chemisorption 90-95 and 80%, respectively.

18060 APTIC NO. 36511

McDonald, D. P.

DUST CONTROL. *Mfg. Chemist Aerosol News (London), 42(12):54, 58, Dec. 1971.*

There are three broad reasons why dust control is necessary in industry and all three apply to the pharmaceutical and cosmetics industries. First, dust may constitute a nuisance to workers and have an adverse effect on machinery. Second, the dust may be valuable and its recovery worthwhile. Finally, the dust may constitute a health hazard. Just as there are three reasons for control, there are three basic types of equipment: cyclones, wet arresters, and fabric filters. The advantages and disadvantages of each type are reviewed and currently available commercial collectors are described.

18061 APTIC NO. 36920

Mercer, Joe F.

METHOD AND APPARATUS FOR REMOVING SMOG AND SMOKE. *(Assignee not given.) U. S. Pat. 3,572,264. 4p., March 23, 1971. 5 refs. (Appl. Sept. 11, 1969, 4 claims).*

An inexpensive, uncomplicated method and device are presented for removing objectionable residue from a smoke stack or an incinerator discharge. The first part of this arrangement receives the effluent or smoke from the incinerator or stack, passes the burned gases through a U-shaped washing tower, and propels the gases by blower through a conduit into a washing filter and then into a discharge stack. The second part of the arrangement utilizes a similar combination; however, the products of burning are recycled, washed, filtered, and returned to the incinerator. This recycling process possesses certain advantages by maintaining the discharged gases at an elevated temperature thus reducing condensation in the components.

18062 APTIC NO. 36118

Meyers, Sheldon

A SYSTEMS ANALYSIS STUDY OF THE INTEGRATED IRON AND STEEL INDUSTRY. *Preprint, United Nations, New York, 20p., 1971. 2 refs. (Presented at the Seminar of Problems of Air and Water Pollution Arising in the Iron and Steel Industry, Leningrad, USSR, Aug. 23-28, 1971.)*

In June 1968, a study of the iron and steel industry was initiated to determine the present status of air pollution control technology, the cost of applying present technology to emission sources, and the areas in which research and development were needed to improve the technology and economics of air pollution control. A detailed literature search was undertaken, a questionnaire was sent to the industry, and inhouse data were gathered. A material balance was described to identify particulate and gaseous emissions, especially sulfur oxides, and to trace the flow of sulfur through representative models of the process segments. Total industry fuel and energy utilization, types of fuels used, quantities of each fuel used, determinants of fuel choice, and an interpretation on the influence of fuel usage and chemistry on pollutant emissions were reviewed. Industry growth and process technology changes are projected for the periods 1970 to 1975 and 1975 to 1980. The principal types of control equipment for the various processes are described, including their relative merits and limitations. Costs are compared.

18063 APTIC NO. 36475

Minakami, M., S. Oote, A. Matsuura, and I. Ogawa

EXHAUST AMMONIA TREATMENT IN A FERTILIZER PLANT. *(Bohiryo kojo no haishutsu ammonia ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):181, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Among pollutants identified in the exhaust (ammonia, sulfur dioxide, chlorides, fluorides, sulfates, and phosphates), NH3 showed extremely high concentration. The source of such high ammonia concentration was traced to a small amount of byproduct, ammonium orthophosphate which readily decomposes at 100 C, giving ammonia. A substantial reduction in ammonia concentration was achieved by lowering the pH value of scrubber liquid. By this treatment, the ammonia concentration was reduced from 660 ppm to 6.60 ppm; however, the concentration of other oxidative gases was slightly increased.

18064 APTIC NO. 37210

Mitsumata, Heijiro, Shinichi Keuke, and Masaru Kondo

ELECTROSTATIC PRECIPITATOR. *(Denki shujin sochi). Text in Japanese. (Tokyo Shibaura Electric Co., Ltd (Japan)) Japan. Pat. Sho 46-37996. 3p., Nov. 9, 1971. (Appl. June 15, 1966, 1 claim).*

In an electrostatic precipitator, when a set amount of corona current is not obtained, the dust collection rate decreases. For this reason, a reactor is inserted into the converter and pressure is controlled; but if sparks are discharged in a precipitator and they move onto the arc, the dust collection performance rate drops. There are ways of controlling the reaction to prevent sparks from moving over to the arc, but this involves complication of the system and higher expense. In this invention, a three-phase static triple converter was used in order to transform alternate current into high pressure direct current. The primary wiring goes through three tap converters, three wave control reactors and the power source switch, and is connected with the three alternate current sources. The three control reactors adjust the high cycle current from the three sources and control wave distortions. A condenser is inserted for supplimenting basic wave formation between each tap converter and reactor. Both ends of secondary wiring are connected with an inner reactance supplimentary condenser, and the condenser is connected with the bridge reactifier. When a given amount of electricity is impressed on the primary wiring, it is converted to a pressure of triple voltage, increasing the precipitator s capacity for dust collection.

18065 APTIC NO. 37162

Miura, Masakattu, Tomoo Hamada, Fukashi Arai, and Shigeo Mitsui

FUNDAMENTAL RESEARCH ON DEODORIZATION BY OXIDATION IN FLUIDIZED BED. *(Ryudo nensho-ho ni yoru dasshu ni kansuru kiso kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):182, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The fluid combustion method for the removal of odors emitted during marine product processing was evaluated. The chemical components of bad odors are amines and mercaptans, in this case. A liquid containing bad odors is pumped into an odor vaporizer with air, where the odorous gas concentration is regulated by the contact ratio of liquid and air. The odorous gas produced is then passed through a fluid layer packed with refractory particles (300-700 C) at theta g equals 0.1-0.5 sec. The odor concentration was measured at the inlet and outlet of the fluid layer by gas chromatography. A removal rate of 95% was achieved at the following operating conditions: amines, theta g equals 0.1 sec at 470 C, 0.3 sec at 430 C, 0.5 sec at 390 C; mercaptans, theta g equals 0.1 sec at 580 C, 0.3 sec at 540 C, 0.5 sec at 460 C.

18066 APTIC NO. 36469

Murakami, Tadashi

COUNTERMEASURES TO PREVENT DUST IN LOADING AND TRANSPORTING RAW MATERIAL. *(Genryo kaeki yuso setsubi ni okeru funjin boshi taisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):178, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The emission of particulate matter at various stages of the metallurgical process at steel mills was investigated and classified into three categories: dust caused by wind or ascending current, dust caused by mechanical processes such as crushing and mixing, and dust emitted during transport, charging, and unloading. The control measures corresponding to each pollutant source are discussed. The water spraying method was evaluated with respect to the amount of water sprayed, efficiency of equipment, and effect of other factors such as wind. The function of hoods and design standards, and improvement in sealing structure are also discussed.

18067 APTIC NO. 36899

Muraki, Naotake

PRESENT STATE OF COUNTERMEASURE FOR EXHAUST GAS FROM DIESEL ENGINE. *(Dizeru kikan ni okeru haishutsu gasu taisaku no genjo). Text in Japanese. Preprint, Japan Society of Mechanical Engineering, Tokyo, 15p., 1971. 20 refs. (Presented at the Seminar on Environmental Pollution by Internal Combustion Engine and its Countermeasure, Tokyo, Japan, Nov. 29-30, 1971.)*

Various pollutants in automotive diesel engine exhaust are discussed. Hydrocarbons from the blowby of a diesel engine are caused mostly from the leakage of compressed air, and are limited to 0.1% of the total exhaust. The black smoke is caused by incomplete combustion of injected fuel which has to be burned in an extremely short time after ignition. The air/fuel ratio in the combustion chamber of a diesel engine is extremely uneven. The carbon in the fuel burns from the heat supply and the limited oxygen supply from gas turbulence, but as soon as the fuel supply stops, the temperature drops and carbon is emitted as incompletely burned black smoke. The reaction of oxygen and nitrogen increases under high temperature as an exponential function of temperature. The combustion process of a diesel engine is extremely complicated and multiple factors play in the formation of nitric oxide, such as the combustion method and processes, the type of fuel injection, and turbulence; satisfactory studies have not been done. It is probably necessary to examine the air/fuel ratio of various parts of the combustion chamber locally, and study the relationship with timing, fluctuation of temperature, and distribution in relation to the total combustion area. Other diesel engine emissions include odor, white or blue smoke, and sulfur dioxide. The smoke consists of hydrocarbons and should not occur under normal conditions. The sulfur dioxide emission is relatively limited and can be solved by reducing the sulfur content in fuel. Presently, the control of NO and black smoke is emphasized. Avoiding uneven mixtures of fuel, maintaining uneven zones in the combustion chamber, and lowering combustion temperature are ways of controlling NO. The control methods of black smoke are directly contradictory to those of NO. An even mixture of fuel, an increase of premixture combustion before the delayed spark timing, reduction of combustion spread after fuel injection, and rapid combustion are suggested. The influences of air/fuel ratio, the shape of the combustion chamber, the injection time, turbulence intensity, fuel-injection ratio, water injection, emulsified injection, the air-intake amount, and fuel quality are discussed.

18068 APTIC NO. 36257

Nabieva, Z. M., N. U. Rizaev, K. V. Merenkov, and M. M. Yusipov

**THE STUDY OF PURIFICATION OF FLUE GASES FROM NITROGEN OXIDES BY KARATAU PHOSPHATE.** *(Issledovaniye ochistki vykhlopnykh gazov ot okislov azota fosforitom Karatay). Text in Russian. Uzbeksk. Khim. Zh., 13(5):84-85, 1969. 9 refs.*

The adsorption of nitrogen oxides from effluent gases on a column of Karatau phosphate was studied. The degree of gas purification achieved was 0.005%. The dynamic exchange capacity of the phosphate column was 0.22 g/g. The following optimum conditions of the process were found: velocity of the gas flow through the phosphate column equal to 5000 cu m/cu hour; the height of the phosphate layer in a column, 2-3 times the diameter of the column; and phosphate water content, 10-40%. The method can be applied to the use of nitrogen oxides in fertilizer production. Preliminary saturation of Karatau phosphate with nitrogen oxides saves 30-40% of concentrated HN03 in the production of complex phosphorus-nitrogen fertilizers.

18069 APTIC NO. 36151

Nagiev, A. M. and E. Sh. Allaverdyan

**NEW ABSORBENTS AND CLASSIFICATION OF METHODS OF REMOVING SULPHUR DIOXIDE FROM INDUSTRIAL GASES.** *(Novye poglotiteli i klassifikatsiya sposobov ochistki promyshlennykh gasov ot dvuokisi sery). Izv. Vyssh. Ucheb. Zaved., Neft Gaz, no. 11-108-110, 1968. 12 refs. Translated from Russian. National Lending Library for Science and Technology, Yorkshire (England), 5p., 1968.*

The ability of liquid petroleum products, including cracking kerosene, sulfide alkylphenol, naptha, alkylate, gas oil, and lubricant distillates, to absorb sulfur dioxide was experimentally confirmed. Determinations of combined sulfur and free SO2 contents of the absorbents showed that the petroleum products absorb SO2 as a result of chemical reaction between SO2 and hydrocarbon compounds. The liquid distillates had a greater absorbing capacity (96.1%) than the other petroleum products. The new absorbents are included in a classification of methods of absorbing SO2 from waste gas.

18070 APTIC NO. 36297

Nakagawa, Shikazo

**STACK GAS DESULFURIZATION AND LIQUID WASTE PURIFICATION METHOD USING LIME.** *(Sekkai o katsuyo suru haien datsuryu, haisui jokabo). Text in Japanese. PPM (Japan), 3(1):22-29, Jan. 1972.*

The selection of desulfurization method should be made by evaluating by-products and the feasibility of adopting a specific method. The amount of crude oil imports and sulfur content in each type of oil, estimated future demands for sulfuric acid, the transition of demands for ammonium sulfate and the amount of sulfur required for producing it, the transition of demands for sodium sulfite and the amount of sulfur used for the production, demands for gypsum and the amount of sulfur for production, are reviewed by tables and discussed. The desulfurization method using lime and producing gypsum as a by-product was developed in Japan for her specific need. In this system, the flue gas enters the cooling tower and passes on to the first absorber and the second absorber, where lime slurry absorbs sulfur dioxide in the gas. While the exhaust gas goes out the stack, the lime slurry s pH is adjusted to 4.0 to 4.5. The slurry is compressed at 5.0 kg/sq cm, and in a rotary atomizer, the slurry of 60 to 80 C temperature is oxidized by a supply of air bubbles and turns into gypsum. It is then discharged from the oxidation tower and is sent to a centrifuge where gypsum with less than 10% water content is produced. The indirect lime-gypsum production methods include uses of ammonia, or dilute sulfuric acid, or magnesium. Each method of producing gypsum, and other by-product recovery methods are discussed.

18071 APTIC NO. 36523

Nelson, Edwin

**CONTROL OF AUTOMOTIVE AIR POLLUTON.** *J. Environ. Health, 34(3):304- 310, Nov./Dec. 1971. (Presented at the Annual Education Conference, 35th.)*

Progress made by General Motors in controlling automotive emissions and company plans for producing an essentially pollution-free vehicle are discussed. Between 1960 and 1971, the company achieved an 80% reduction in hydrocarbon emissions and a 65% reduction in carbon monoxide emissions from its cars. All 1971 models meet the California standards for nitrogen oxides. Advanced control techniques under evaluation include improved carburetion, electronic fuel injection, exhaust gas recirculation (EGR), manifold reactors, and catalytic converters. Availability of unleaded gasoline on a nation-wide basis should permit the company to translate some features of these techniques into production cars meeting 1975 standards. Alternate power plants such as turbines and steam engines are also mentioned.

18072 APTIC NO. 36405

Nelson, L. B. and J. C. Barber

**WILL EAGERNESS FOR POLLUTION CONTROL AFFECT FERTILIZER MARKET?** Croplife, 1970:25-28, Jan. 1970.

Depending on the kind of plant or complex, atmospheric emissions from fertilizer plants and ancillary facilities include fluorides (essentially as silicon fluoride), sulfur dioxide, nitrogen oxides, free ammonia, ammonium chloride, and various dusts. Such emissions can be controlled adequately by using electrical precipitators, condensers, mechanical dust collectors, and scrubbers. Recovery and reuse of plant nutrients and salable by-products from emissions and liquid wastes add measurably toward improving efficiency and reducing the cost of pollution abatement. Fluoride can be economically recovered as fluosilicic acid or fluosilicate salts at many locations.

18073 APTIC NO. 36471

Nishino, S., T. Oi, G. Kawasaki, and H. Okumura

THE TREATMENT OF EXHAUST OIL VAPOUR OF HOT FORGING PROCESS. *(Nekkan tanzo kojo no haishutsu gasu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):176, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The efficiency of the water spraying method for the removal of oil vapor during hot forging process was investigated under various conditions. A spray tower with the fume inlet pipe running down inside the tower to the opening at the bottom for cooling purposes, which is packed with coke, was the most effective, with 93% efficiency. The use of the emulsified oil prepared by adding an aqueous solution of surfactant to a forging oil reduced the amount of oil vapor to one-fourteenth.

18074 APTIC NO. 36389

Oels, F.

PRESENT STATE OF DEVELOPMENT OF FLUE-GAS DESULPHURIZING INSTALLATIONS IN NORTHRHINE WESTPHALIA. *(Stand der Entwicklung von Anlagen zur Entschwefelung von Abgasen im Land Nordrhein-Westfalen) Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 206-208. (Oct. 4-7, Paper VI/17.)*

The development of stack gas desulfurization techniques in West German industries is reviewed including the Reinluft process in a chemical processing plant, coupled with a sulfuric acid plant, a Claus oven plant, and an oil-burning installation; a pitcoal power station to test the process with different furnace types; a method for sulfur oxides control worked by blowing lime or dolomite into the boiler; and desulfurization via absorption of sulfur dioxide on wet lignite coal filter ash.

18075 APTIC NO. 36158

Ohigashi, S., H. Kuroda, Y. Nakajima, Y. Hayashi, and K. Sugihara

HEAT CAPACITY CHANGES PREDICT NITROGEN OXIDES REDUCTION BY EXHAUST GAS RECIRCULATION. *Preprint, Society of Automotive Engineers, Inc., New York, 10p., 1971. 6 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710010.)*

The hypothesis that exhaust gas recirculation (EGR) reduces nitrogen oxides by increasing the heat capacity of combustion gases was tested in an experimental program involving the admission of inert gases, such as helium, argon, hydrogen, and carbon dioxide, and water in place of EGR. Test data confirmed the validity of the hypothesis and also indicated that increased heat capacity retarded combustion and increased specific fuel consumption. Data for CO2 admission also indicated an increase in hydrocarbons at lower air-fuel ratios in the lean range, due to misfiring. Accordingly, a 15:1 air-fuel ratio is recommended for EGR.

18076 APTIC NO. 37164

Oote, S., Y. Nakagawa, M. Minakami, and I. Ogawa

EXHAUST FLUORIDES FROM GYPSUM PLANTS. *(Sekko kojo no haishutsu fukkabutsu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):187, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The hydrogen fluoride emission from a rotary kiln used in the manufacture of plaster of Paris was greatly reduced by a simple modification of the procedure. The colorimetric measurements indicated the variation in HF concentration during the processing, and that HF concentration was greatly reduced by the addition of neutralizing agents. By the addition of up to 0.50% of neutralizing agent, the HF concentration was markedly reduced from 81.8 ppm to 0.95 ppm. The relationship between HF concentration and pH was also investigated, so that the effect of pH on the product could be controlled.

18077 APTIC NO. 36271

Pantaleoni, R.

AN APPROACH TO ODOR CONTROL. *J. Air Pollution Control Assoc., 5(4):213-215, Feb. 1956. 10 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 48th, Detroit, Michigan, May 23-26, 1955.)*

Odorant samples collected by absorption and adsorption with liquid or with porous substances were used for formulation of counteractants by the following methods: malodor, infrared testing, and atomization. In the first method, counteractant mixtures were tested on blotter strips until satisfactory odor control was verified by experts. The second method involved infrared spectrophotometric analysis of extracted and dried samples and the third the release of aerolized malodors into an odor-free room. Products tested as odor counteractants included surfactive agents, nonsurface active sulfonates, chelate-type oxygen absorbent compounds, sulfamates, aldehydes, ketones, olefins, conjugated diolefins, and acetylenes. Such tests led to the development of thousands of individual chemical odorants and essential oils with vastly different odor intensities and odor qualities. The aqueous odor intensity of a few individual products is listed in increasing order. Results of odor counteraction tests made in this way are directly applicable to the problem of determining the quantities of counteractant needed.

18078 APTIC NO. 36248

Pell, Melvin

REACTION OF HYDROGEN SULFIDE WITH FULLY CALCINED DOLOMITE. *New York City Univ., N. Y., Dept. of Chemical Engineering, Thesis (Ph.D.), 1971. 209p. 34 refs.*

Calcined dolomite is a candidate acceptor for hydrogen sulfide in processes for gasifying or pyrolyzing sulfurous fuels, such as coal and residual oil, to provide power stations with sulfur-free fuels. Preferably, the processes would be satallite to power generating apparatus. Differential kinetic data are given for the reaction between H2S and dolomite at H2S partial pressures between 0.003 and 0.2 atm. The data were obtained gravimetrically for both spherical and powder samples of stone. Sphere data at 950 C show that the reaction is controlled by ash-layer diffusion at this temperature. The solid calcium sulfide and maghesium oxide produced at 950 C displays an internal effective diffusivity approximately six percent of the diffusivity in open space. This should be a fair approximation for its effective diffusivity at lower temperatures. Sphere data at lower temperatures indicate that the reaction generally occurs homogeneously throughout the solid and at a rate proportional to the quantity of unreacted CaO remaining in the sample. Although a concentration gradient was observed near the surface of a six mm sphere reacted partially at 625 C, negligible gradient in CaS concentration would be expected in a particle of powder size. The main features of data obtained for a powder suggest that activated adsorption of H2S by unreacted CaO hinders the rate, the adsorption generally not at equilibrium. The activation energy of the reaction kinetic constant is estimated at 23 kcal/g mole. Some effects of steam concentration, hydrogen concentration, and sintering on the activity of calcined dolomite are discussed. (Author abstract modified)

18079 APTIC NO. 36450

Pinkerton, J. D.

THE INFLUENCE OF TURBULENCE AND COMPOUNDING ON UNBURNED HYDROCARBONS AND NITRIC OXIDE IN THE COMBUSTION PRODUCTS FROM INTERNAL COMBUSTION ENGINES. *Preprint, American Society of Mechanical Engineers, New York, 9p., 1970. 12 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, New York, Nov. 29-Dec. 3, 1970, Paper 70-WA/DGP-2.)*

A Waukesha CFR, variable compression-ratio, single-cylinder engine with special inlet and exhaust systems was used to investigate the influence of turbulence and exhaust work compounding on the amounts of unburned hydrocarbons and nitric oxide in the engine exhaust. The influence of turbulence on the exhaust gas emissions was determined by varying the engine speed and using a shrouded inlet valve. The effect of exhaust turbine compounding was simulated by throttling the exhaust gases and calculating the reversible adiabatic exhaust work. Specific hydrocarbon and nitric emissions and specific fuel consumption were plotted against exhaust pressure. The influence of turbulence on the cold wall quenching mechanism in the engine cylinder during combustion is to decrease hydrocarbon emissions with increased turbulence. Decomposition of nitric oxide occurs in the engine cylinder and exhausts for rich air-fuel mixtures. Decreasing engine speeds result in decreased nitric oxide. The effect of exhaust compounding on Otto cycle and using a well-insulated exhaust reactor is to produce an essentially emission free engine. (Author abstract modified)

18080 APTIC NO. 36885

Rawa, Ronald T.

SO2 CONTROL FOR SMALL BOILERS. *Pollut. Eng., 4(1):22-23, Jan./Feb. 1972.*

Caustic wet scrubbing can be geared to the small industrial coal user whose boilers have steam capacities from about 50,000 to 500,000 lb/hr. Stack gases containing 0.1-0.3% sulfur dioxide, a small amount of sulfur trioxide, and fly ash are passed through a quench chamber for cooling and on through a packed crossflow scrubber utilizing a caustic scrubbing solution. Spent scrubbing liquor is treated with a lime slurry, and the caustic is regenerated and returned to the scrubber. The slurry of precipitated solids and fly ash from the gas stream is thickened, filtered, and removed for disposal. The filtrate is returned to the main body of thy scrubbing liquor in order to conserve dissolved salts. If water is used in the quench, SO3 will be removed and form sulfuric acid. Although the chemistry in the absorption and regeneration stages is complex and the exact mechanisms not well understood, steady-state operation of the system demands little more than filtered solids, all at a constant rate. Advantages associated with the scrubber system are cited. (Author abstract modified)

18081 APTIC NO. 36299

Richardson, Harry Lee and Robert Culp Craig

AN ELECTROSTATIC SEPARATOR. *(Elektrostatische Ausscheidevorrichtung). Text in German. (Chemical Construction Corp., New York) W. Ger. Pat. 2,103,022. 12p., July 29, 1971. (Appl. Jan, 1971, 7 claims).*

The equipment is designed to separate droplets and solid particles like fly ash, soot, or dust from flue and other waste gases emanating from various chemical processes. It consists of a horizontal gas duct with a series of vertical alternating perforated plates and wires. The perforations in the plates are circular holes or oblong slots arranged parallely with the wires. A set of six parallel ionizing wires connected with an outside source of a 40 V electric current projects downward into the duct midway between each pair of neighboring grounded plates. The plates are equipped with sprinklers for the removal of adhering particles or with some other device serving the same purpose. The diameter of the duct increases in the direction of the gas flow which slows down flow velocity and prevents the creation of turbulence and the refloating of particles already settled on the plates. The separator with six plates works with 92.5% separation efficiency in removing dust from a stream of gas containing three g dust/sq ft and moving at one m/sec.

18082 APTIC NO. 37160

Saleem, A.

DESULPHURIZATION OF COAL. *Ont. Hydro Res. Quart., 23(2):29-34, 1971. 16 refs.*

Many methods are available for the desulfurization of coal, but most of them do not remove organic sulfur; laboratory work indicates that only 60-70% of the pyritic sulfur can be removed. Gravity separation using an air-classifying system and special cleaning devices is a practical means of removing pyrite sulfur. Froth flotation achieves substantial reduction in ash content but an insignificant reduction in pyrite. Magnetic separation of pulverized coal provides substantial sulfur reduction in some coals and small reduction with a few coals. Electrostatic separation achieves only a modest reduction in sulfur. Bacterial oxidation requires long periods of bacterial activity for sulfur or pyrite removal. Flash carbonization of 20-40 mesh coal can remove 59% of the sulfur, and digestion (leaching) of 40-mesh coal with caustic results in removal of pyritic sulfur in five minutes. However, costs of thermal and chemical treatments are high. Solvent refining of 200-mesh coal produces coal with a greatly reduced ash and pyritic sulfur content, but does not remove appreciable amounts of organic sulfur and is also costly. A knowledge of the quantity of pyrite in coal and its size distribution is essential in selecting a pyrite separation technique. The ideal situation would be where pyritic sulfur constitutes a substantial portion of the total sulfur in coal and where the pyritic particles are relatively coarse. However, the quantity of pyrite in a series of coals tested was about 1%, a little less than half the total sulfur in the samples. Grinding to 200 mesh liberated 70% of the pyrite content, the maximum limit attainable by physical means. If organic sulfur content averages 1%, the product will still have about 1.8% sulfur after 60% pyrite removal. Since organic sulfur is not amenable to physical separation, successful desulfurization requires that the organic sulfur content of a coal be as low as possible.

18083 APTIC NO. 36853

Salvi, G. and E. Zanella

UTILIZATION OF SODIUM ALUMINATES FOR THE ABSORPTION OF SULFUROUS DIOXIDE FROM FLUE GASES. *(Impiego degli alluminati di sodio nell abbattimento dell anidride solforosa dai gas di combustione). Text in Italian. Riv. Combust. (Milan), 25(9):353-365, Sept. 1971. 6 refs.*

The absorptive capacity of commerical grade sodium aluminates for sulfur dioxide was studied to determine if aluminates could replace the more expensive activated aluminas in stack-gas purification processes. The aluminates had a high capacity for absorption but were difficult to regenerate by conventional methods. To overcome this difficulty, a two-stage process was devised, the first stage was reduction of sulfate to sulfide with hydrogen, and the second was a subsequent shift of sulfur as hydrogen sulfide by means of a stream of steam and carbon dioxide. Reaction kinetics of the process are discussed.

18084 APTIC NO. 36295

Sano, H.

COMPARISON BETWEEN VARIOUS DESULFURIZATION METHODS (2). COMPARISON BETWEEN DESULFURIZATION METHODS OF STACK GAS. *(Datsuryuho no hikakuron (2). Haien datsuryu no hikakuron). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 23(12):10-16, Dec. 1972.*

The dry and wet methods of desulfurization are reviewed by tables with regard to the process, plants in operation, the size and scale, absorbents used, recovery methods, and the by-products. Adsorption of sulfur dioxide by activated carbon and oxidation cayalysts presents problems such as deterioration of adsorbent, high cost, the difficulty in enlarging the adsorption system, the treatment of diluted sulfuric acid, and the installation of sulfuric acid plant. Creation of sulfuric acid concentrate, ammonia sulfate, or plaster, by ammonia or lime addition presents the problem of corrosion of boilers, flues, and preheaters. The process requires a high temperature dust collector and the secondary dust collector for sulfuric acid mist. The activated manganese method can oxidize SO2 at a lower temperature, but multi-leveled dust collectors are necessary for the recovery of manganese dusts. In general, desulfurization process of any type presents problems of one type or another, such as the consumption of large amounts of neutralizer, absorbent, adsorbent, or reduction agent, which are all expensive. By-products of desulfurization process are generally bulky, and unless there is enough demand for such products, they create an additional problem. Various by-products are reviewed per unit of the original oil, and demands for such by-products per year are compared. Problems in improving boilers and flues, and projected technical developments in the future are discussed.

18085 APTIC NO. 36415

Sasabe, Yoshinobu and Genjiro Sakanaka

**PREVENTION OF ACID RESIDUE FORMATION IN OIL-BURNING POWER STATION BY THE ADDITION OF AMMONIA.** *(Anmonia chunyu niyoru juyu sensho karyoku hatsudenjo no ashiddo sumatto hassei boshi nitsuite). Text in Japanese. Nenryo oyobi Nensyo (Fuel and Combustion), 34(3):209-217, March 1967.*

Acid residue forms during the burning of oil because sulfur trioxide, formed during sulfur dioxide oxidation, is absorbed on carbon particles, comes together when temperature decreases, and finally grows into a snow fume. Using a tetron filter, the acid residue was collected in a power plant at chimney mouth. Ammonia gas was obtained by evaporating liquid ammonia, mixed with air and fed to the flue through 729 nozzles. Sulfur trioxide was monitored at the chimney entrance by the method for measuring total sulfur oxides specified in the Japanese Industrial Standard. In the flue at the chimney entrance, the dew point was monitored by a electric-conductivity meter. The acid residue formation and SO3 concentration was studied with various oxygen amounts and ammonia addition. With a decrease in 02 percentage, a decrease, in SO3 and dew point was observed. The acid residue also decreased, showing that SO3 is a direct cause for the acid residue. Ammonia addition decreased SO3 by inhibiting its formation from SO2 and decreased the dew point temperature to 45 C. The dust at the mouth of the chimney was neutralized to pH 7. Thus, ammonia addition was extremely effective as a countermeasure for acid residue formation. At the Kasugade power plant the acid residue is completely eliminated by the addition of 0.03% ammonia for oil with a high sulfur content and 0.01% for oil with a low sulfur content.

18086 APTIC NO. 37185

Schneider, A.

**NEW POWER PLANT UNIT FOR CHEMICAL PLANT.** *(Neuer kraftwerksblock fuer Chemiewerk). Text in German. Energie (Munich), 23(11):343-355, Nov. 1971.*

The original power plant of a chemical complex was built in 1941. It consisted of 10 furnaces; the flue gases were cleaned in vertical electrostatic precipitators. Later multicyclones were added and the steel stacks with an original height of 50 m were raised to a height of 64 m. In the course of a program to curb emissions, the dust emission by the old plants was limited to 300 mg/cu m air, which made a further extension of the stack to a height of 100 m necessary. Also, the rising power demand lead to the addition of an additional unit to the plant. Five additional electrostatic precipitators had to be installed for the 10 old furnaces. The flue gases of the new unit are passed downward in an empty flue and enter the electrostatic precipitators. The fly ash collected in the precipitators can be returned to the combustion chamber or stored in the silos.

18087 APTIC NO. 36919

Schoenthaler, Edward P.

**AIR SCREEN APPARATUS WITH FILTER REMOVAL MEANS.** *(Assignee not given.) U. S. Pat. 3,572,234. 5p., March 23, 1971. 2 refs. (Appl. April 24, 1969, 11 claims).*

An improved air screen apparatus is described, of the type which can be adapted to direct a flow of air across an opening such as a door or window in order to prevent dust or insects from entering, while at the same time leaving the opening free of obstructions. The apparatus comprises a frame, one side of which is adapted to be mounted in juxtaposition with respect to the structure adjacent the opening. Mounted within the frame is an air-propelling means such as a fan or a plurality of fans. An air-directing means, such as a set of louvers, is carried by the frame downstream from the air-propelling means and is adopted to direct the air from the air-propelling means across the opening in the structure. A pair of separate filter panels are carried by the frame, these are mounted in a spaced relationship with respect to and upstream from the air-propelling means. The filter panels are angularly disposed with respect to one another, coming together to form the top ridge of the apparatus, and one of the panels has a bottom edge disposed along the side of the frame that is adjacent the wall on which the apparatus is mounted. The novel filter arrangement provides a greater filter area and more efficient filtering operation, while the filter elements are mounted in such a manner as to permit them to be readily removed for cleaning and replacement.

18088 APTIC NO. 37173

Schwarzenbek, Eugene F.

**CATALYTIC REFORMING.** *Advan. Chem. Ser., no. 103:94-112, 1971. 5 refs. (Presented at the American Chemical Society and the Canadian Society for Chemical Engineering Joint Conference, Toronto, Canada, May 24-28, 1970.)*

The role of the catalytic reforming process in meeting the future demand for high octane lead-free gasoline is discussed. An increase in the severity of reforming is needed to produce aromatic-rich fractions with octane numbers as high as 110. Octane improvement in catalytic reforming is a result of the dehydrogenation reaction to form aromatics and a hydrocracking reaction to convert higher-boiling paraffins to lower-boiling higher octane material. Pressure is the operating variable controlling the relative amounts of these two reactions. Hydrocracking is promoted by high pressure, dehydrogenation by low pressure. Higher pressures increase gas and butane production, while lower pressures show a greater advantage in liquid product yield. The new platinum-rhenium catalysts show improved stability and will allow the design of low-pressure semiregenerative systems without the requirement of high-investment regeneration facilities. The economics of a semiregnerative unit operating at 200 psig are detailed. Even at this pressure, the selectivity is more for hydrocracking than dehydrocyclization, so further improvement in catalyst formulation is needed. (Author abstract modified)

18089 APTIC NO. 36870

Shah, Indravadan S. and Alexander Kirschner

**WET APPROACH VENTURI SCRUBBER.** *(Chemical Construction Corp., New York) U. S. Pat. 3,567,194. 8p., March 2, 1971. 5 refs. (Appl. June 20, 1969, 19 claims).*

Numerous improvements in the basic venturi scrubber have been developed, and in one configuration a project lip is provided at the base of the approach or converging section of the venturi so that the scrubbing liquid will flow downward into the gas stream. An improved venturi scrubber is described in which the projection lip is disposed within the approach section and spaced above the throat section, with the lip terminating with a greater dimension or diameter than the throat itself. The present apparatus produces a longer zone of high velocity turbulence due to earlier distribution of liquid. An annuar venturi configuration may be defined, in which the central conical baffle is also provided with a projection lip, which is spaced above the lower terminus of the conical baffle and has an outer dimension or diameter less than the dimension of the base of the conical baffle.

18090 APTIC NO. 37209

Shibahara, Toshio

AIR CLEANER FILTERS. *(Kuki seijoki no firuta-so). Text in Japanese. (Matsushita Seiko K. K. Osaka (Japan)) Japan. Pat. Sho 46-32307. 2p., Nov. 8, 1971. 1 ref. (Appl. March 14, 1968, 1 claim).*

The changing of various filters in an air conditioning unit was simplified by joining various filters by one outer frame. In an ordinary air conditioning or cleaning unit, a pre-filter, a deodorizing filter, a glass fiber rear filter, and high performance filter have to be inserted individually into the outer shell, and each has to be stabilized in the limited space. This device permits each filter to be fitted into various L-shaped frames; one end of the filter layer is snapped into a hook shaped outer frame. One end of this outer frame hooks into one of the individual frames and the other end has an R-shaped spring which holds the layer of filters together. Thus, all filters are stabilized as one unit, and can be easily inserted into the air-conditioner shell.

18091 APTIC NO. 37200

Simura, Osamu, K. Umesawa, H. Tasiro, Y. Tsukamoto, K. Hashimoto, and T. Maeshima

TREATMENT OF HYDROGEN SULFIDE GAS AT TAGONOURA HARBOR. *(Tagonoura ko no chinden odei kara hassei suru ryuka suiso gasu to sono shori ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):224, 1971. (Presented at the Nation Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

During the dredging work in Tagonoura harbor in April and May 1971, the method of removing hydrogen sulfide from the polluted slurry was investigated. The amount of H2S and total sulfides in the slurry were estimated to be 1.94 + or 0.18 kg and 3.36 kg as s/t dry solid, respectively. The H2S concentration was reduced to a satisfactory level by adding 1500 ppm of slacked lime and 130 ppm of iron chlorides to the slurry with 1.5% solid. Slacked lime as 10% slurry and iron chlorides as 39% solution were added into the slurry transporting pipe, so that the H2S concentration would be maintained below 5 ppm.

18092 APTIC NO. 36884

Sisson, William

ESTIMATING FLY ASH EMISSIONS. *Pollut. Eng., 4(1):31, Jan. 1972. 1 ref.*

A quick method is presented for making a rough estimate of the pounds of particulate discharged to a receiving stack or dust collector, and the emission in pounds of fly ash per million Btu. This method can be used to determine the type of collector needed. (Author introduction modified)

18093 APTIC NO. 36321

Smith, Malcolm C.

PROBLEMS OF CONVERSION TO LOW-SULFUR RESIDUAL FUEL OIL. *Metropolitan Engineers Council on Air Resources, New York, N. Y., Proc. MECAR Symp. Design and Operation for Air Pollution Control, New York, N. Y., 1968, p. 18-25. (Oct. 24.)*

Low sulfur (one percent) African oil supplied to Con Edison was found to have a parafinic or waxy base instead of an asphaltic base. To prevent the wax within the oil from solidifying at the pour point of the oil, it was necessary to hold the oil above the pour point from the time it was received until it was actually used. Applying a 12-degree margin for pour point test inexactness to the maximum guaranteed 90 F pour point gave a minimum design temperature of 102 F. This requirement was achieved by a combination of methods: heating the oil by steam tracing; heating the oil by electrical tracing; and recirculating the oil in such a way that its temperature did not drop to the pour point before it returned to a place where it was reheated.

18094 APTIC NO. 36287

Soo, S. L. and L. W. Rodgers

FURTHER STUDIES ON THE ELECTRO-AERODYNAMIC PRECIPITATOR. *Powder Technol. (Amsterdam), 5(1):43-49, Nov. 1971. 14 refs. (Presented at the International Powder Technology and Bulks Solids Conference, Harrogate, England, May 12-14, 1971.)*

In an electro-aerodynamic precipitator a set of high voltage wire electrodes is installed at a finite distance from a set of collector plates of the opposite polarity. The direction of the electric field formed between the electrodes and the plates is aligned with the direction of the dust-laden gas flowing into the precipitator. These alternately charged plates mounted on a drum are then rotated below cleaning shoes where the dust is removed and drained into a sump. In such a configuration, electric wind and field have the same directions as the dusty gas flow. This, together with small passages which maintain laminer flow, eliminates reentrainment of electric wind and turbulence. The corona current also increases with dust loading, thus maintaining high operating efficiency at heavy loading. A small-scale preliminary experimental study has demomstrated that such a precipitator provides consistently high efficiency (above 99%), compactness, and light weight. When collecting fly ash, it does not depend on the sulfur content of the ash for high operating efficiency. Highest efficiency obtained so far has been 99.98% with cigarette smoke. (Author summary)

18095 APTIC NO. 36056

Spurny, Kvetoslav and Emil Wiesner

IMPROVEMENTS ON OR RELATING TO COMPOSITE FILTERS. *(Ceskoslovenka Akad. Ved, Prague) Brit. Pat. 1,122,638. 2p., Aug. 7, 1968. (Appl. Oct. 27, 1965, 6 claims).*

The double layer filter described is capable of capturing samples of industrial aerosol mixtures and coarsely dispersed dust. The filter comprises two juxtaposed layers of filtering medium. The first layer can collect particles above one micron in size; the second layer captures particles between 0.1 and one micron. The first layer of the filter is made of chlorinated polyvinylchloride fibers and the second layer is of a nitrocellulose xerogel. The filter is made by cold-pressing the two layers together and uniting them by means of a punch heated to a temperature below the melting points of the filter material. The filter is then cut to the desired shape.

18096 APTIC NO. 36893

Steuernagel, Walter

CLEANING DEVICE FOR ELECTROSTATIC DUST COLLECTOR DISCHARGE ELECTRODES. *(Metallgesellschaft A. G., Frankfurt (West Germany)) U. S. Pat. 3,570,217. 4p., March 16, 1971. 7 refs. (Appl. July 8, 1969, 4 claims).*

In electrostatic gas cleaning, the dust settles not only upon the collecting electrodes provided for this purpose, but also on the discharge electrodes. A method for rapping an electrode framework to obtain vibrations of different direction and intensity is described. Dust is shaken from the discharge electrodes by hitting an anvil secured to the framework, alternately striking a vertical side and a side at an acute angle to the vertical side.

18097 APTIC NO. 36188

Stokes, Rufus

EXHAUST GAS PURIFIER. *(R. S. Engineering Co., Inc., Chicago, Ill.) Brit. Pat. 1,187,721. 5p., April 15, 1970. (Appl. Feb. 7, 1968, 6 claims).*

A simple and inexpensive device for removing both large and fine impurities from exhaust or other gases is described which comprises a primary tank adapted to receive exhaust gas into a liquid partially filling the tank; a secondary tank surrounding the lower portion of the primary tank; a pipe connecting the tanks; agitator pumps from the secondary tank; and a second pipe surrounding the first pipe. A conduit connects the circulating means with the first tank above the level of the liquid. A mixture of gas and liquid from the two tanks is circulated to create a pressure barrier on the surface of the liquid in the first tank. An open-bypass is provided so that a portion of the circulating gas/liquid mixture can be passed between the two tanks to relieve the pressure on the liquid surface of the primary tank. A conduit is also provided for passing the gas/liquid mixture from the upper part of the primary tank to a third liquid-containing tank which has an impeller for scrubbing the mixture.

18098 APTIC NO. 36186

Strezhnev, I. V. and V. I. Samoylov

ON THE CALCULATION OF EQUILIBRIUM SULFUR YIELDS IN SULFUR PRODUCTION FROM GASES OF WATER-JACKET FURNACES IN CLOSED SMELTING PROCESS. *(O raschete ravnovesnykh vykhodov sery, poluchayemoy iz gazov vaterzhaketnykh pechey pri zakrytoy plavke). Text in Russian. Tr. Ural. Nauch.-Issled. Khim. Inst., no. 7:171-186, 1958. 13 refs.*

The water-jacket furnace gas used for sulfur production is of complex composition, and a number of reversible reactions take place when the temperature is changed. The process was analyzed theoretically; equations were derived which are necessary for calculation of gas composition. Two cases were considered: Eleven components are present in equilibrium gas (sulfur dioxide, hydrogen sulfide, carbon dioxide, carbonyl sulfide, water, nitrogen, and sulfur $S_2$, $S_4$, $S_6$ and $S_8$); the equilibrium gas has nine components (same as before, only COS and $CS_2$ are missing). From the equilibrium composition of the gas, the sulfur yield can be calculated and the optimum composition of parent gas mixture found. In the first case, 11 equations in 11 unknowns can be reduced to seven equations in seven unknowns. Equilibrium constants necessary for the calculation were obtained either from the literature or calculated from free energy data. Solution of the second case was reduced to a set of four equations in four unknowns.

18099 APTIC NO. 36059

Sundaram, M. and N. B. Bhattacharyya

A STUDY OF DESULPHURIZATION OXIDE. *Technol. (Sindri), 7(3):130-134, 1970. 5 refs.*

Removal of hydrogen sulfide from industrial grass using hydrated oxides of iron is one of the cheapest and most popular methods in the gas-processing industry. The dependence of activity on composition, the effect of increasing sulfur content in the purifying mass on activity and capacity, comparative efficiency of regeneration, and the effect of moisture content on activity and capacity were studied in desulfurization oxides. Samples investigated were synthetic iron oxide, diluted mass, Luxmasse, and Dorr thickener sludge. The $H_2S$ absorption rate and capacity of desulfurization mass were dependent on the active iron content only. The rate of $H_2S$ absorption and the capacity of the synthetic and diluted oxides remained practically unchanged even when the accumulated sulfur reached 70% and 50%, respectively. For synthetic oxide, outside regeneration is essential to regain full activity and capacity; for diluted mass, regeneration outside the reactor appears to have little advantage over that in situ. The rate of $H_2S$ absorption did not improve by increasing the moisture content of the oxide above 5%. 0

18100 APTIC NO. 36889

Tajar, Joseph G. and Irving F. Miller

THE PERMEATION OF CARBON DIOXIDE, OXYGEN, AND NITROGEN THROUGH WEAKLY BASIC POLYMER MEMBRANES. *Am. Inst. Chem. Engrs. J., 18(1):78-83, Jan. 1972. 11 refs.*

Permeation, diffusion, and solubility coefficients were measured for carbon dioxide, oxygen, and nitrogen in the four component membrane system, polyethylenimine-polyvinylbutyral-epoxy-water, using a variable pressure technique. Extremely high $CO_2/O_2$ and $CO_2/N_2$ selectivity ratios were obtained. This can be attributed to reversible reactions between the carbon dioxide, water, and polyethylenimine which markedly increases the $CO_2$ solubility in the membrane with respect to those of $O_2$ and $N_2$. The $O_2$ and $N_2$ permeation occurs in the classical manner. The high $CO_2$ selectivity coupled with the good $O_2$ permeability of this membrane makes it potentially useful in an atmospheric control system or in a blood oxygenator. For example, systems have been proposed in which several gas permeation stages would be used to remove $CO_2$ from air in such closed environments as submarines. (Author abstract modified)

18101 APTIC NO. 36430

Termeulen, M. A.

AIR POLLUTION CONTROL BY OIL REFINERIES. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 92-95. (Oct. 4-7, Paper IV/5.)*

Air pollution control by petroleum refineries is reviewed with respect to processes of refining, refinery air pollutants, defined sources, abatement methods, effects of process modifications, and factors governing control methods, i.e., meteorological and topographical conditions, background pollution, and effects on environment. The major emissions include hydrocarbons, sulfur oxides, nitrogen oxides, carbon monoxide, odorous emissions (hydrogen sulfide and mercaptans), and particulate matter (fly ash, dust, and smoke). Specific control methods are described for correlated sources and emissions. These include cyclones, scrubbers, flares, dispersion from stacks, and preventive maintenance

18102 APTIC NO. 36353

Thomas, Colin C.

ECOLOGICAL AND TECHNOLOGICAL ASPECTS OF UTILIZATION OF WASTE DISPOSAL HEAT. *Preprint, American Inst. of Chemical Engineers, New York, 13p., 1971. (Presented at the American Institute of Chemical Engineers. 6th, Houston, Tex. Feb. 28-March 4, 1971.)*

A steel mill required to reduce particulate discharge from open-hearth furnaces and ore-calcining kilns selected a drum heat exchanger to cool effluent gas streams prior to cleaning and to recover some of the available energy in the streams. The exchanger has a continuous spiral fin in cross flow with 30% of the fins in the horizontal plane and the remaining 70% in the vertical plane. This configuration is thought to have the best chance of eliminating or reducing particulate build up on the heat transfer surfaces and of reducing fin and tube corrosion due to particles on the gas stream. There are no internal baffles which could collect particles or moisture. The exchanger is expected to generate steam at 575 psia and 0.8 0.95 quality.

18103 APTIC NO. 36863

TWO HUNDRED FIFTY MILLION LBS OF SOOT AND SOMETHING TO DO ABOUT IT. *Del. Valley Ind., 44(11):46-48, Dec. 1971.*

A soot collection unit is described for use with boiler tubes. These are the tubes in a commercial boiler through which water passes while it is heated, or turned to steam, by the hot furnace gases that weave around the outside of the tubes on their way to the smoke stack. For every 1000 gallons of fuel oil burned there are from 8 to 12 lbs of particulates, mainly soot, created. This invention removes the soot by a scrubbing action so that it can be drained off harmlessly into the sanitary sewer system where it can be filtered out without contaminating our streams and rivers. The system which has been installed at a laundry and dry cleaning establishment is very simple in operation, using Bernouilli s principle. When the tubes are blown, a damper shuts off the stack, and a vacuum created by steam or air draws the soot into the removal unit, where a combination of sprays and baffles drench the soot so that it is carried away with the wash water.

18104 APTIC NO. 37182

Uchiyama, Y., T. Ozaki, K. Motohashi, and Y. Taijun

EGR AS COUNTERMEASURE TO NOX IN DIESEL ENGINE. *(Dizeru kihan no NOx taisaku to shite no EGR). Text in Japanese. Preprint, Ministry of International Trade and Industry, Tokyo (Japan), Government Mechanical Research Lab., p. 1, 1971. (Presented at the Meeting of 0the Government Mechanical Research Laboratory, Tokyo, Japan, Dec. 16, 1971.)*

As a measure against diesel engine nitrogen oxides emission, the effect of partial recirculation of exhaust gas (EGR) was examined. The engine used was a precombustion chamber-type diesel, which is reputed to emit exhaust gas with the lowest NOx concentration. The effect of recirculation was tested up to 40% of the total quantity of air supply. As a result, no change in power output or exhaust smoke were recognized when operating at medium load when 10% was recirculated, and approximately 30% reduction in NOx concentration was recognized. When the excess air rate was close to one, and when the quantity of recirculation was increased, NOx concentration could be effectively decreased but the exhaust gas smoke suddenly increased. In this case, reducing of recirculation quantity and the use of water jet were recommended.

18105 APTIC NO. 36240

Valy, Ferenc

DESULFURIZATION OF INDUSTRIAL GASES. *(Ipari gazok kentelenitese). Text in Hungarian. Magy. Tech., 8(12):700-705, Dec. 1953. 4 refs.*

Various processes for the production of industrial and city gases are described. City gas is always purified and since, with a few exceptions, all the industrial plants in Budapest use city gas, desulfurization is not required. Desulfurized gas proved to be best for metallurgical plants which makes the installation of desulfurizing equipments at the gas producing plants necessary, since most of the utilized brown coals contain a high percentage of sulfur (10-15 gr/cu m of hydrogen sulfide). By desulfurization, 30-35% of the country s need for sulfur or sulfuric acid can be covered. Desulfurization processes fall into two groups; dry and wet processes. Only dry processes have been used in Hungary until now. The iron oxide hydrate process is well-known within the group of the dry processes. In this process, the hydrogen sulfide of the gases is bound by iron hydroxide, and the iron sulfides thus obtained are reoxidized by air simultaneously added to the gas. The activated carbon process is another dry process based on the catalytic action of the activated carbon on whose surface hydrogen sulfide contained in the gas is oxidized to sulfur in the presence of oxygen or air. The major part of hydrogen sulfide and hydrogen cyanide is washed out of the gas by carbonates in a counter current absorption tower in the wet alkaline procedures. The wet basic arsenic process uses alkaline arsenic oxide to wash out sulfur. The ammonia desulfurization process proved to be best among the wet absorption techniques. The sulfur contents are washed out by ammonia solution. This process requires acidification equipment. Other processes indicated include tetanolamine, and sodium phenolate procedure. Newest developments and economic aspects related to the individual processes are discussed.

18106 APTIC NO. 36892

Vincent, Daniel B. and Daniel A. Vincent

DESTROYING ODOROUS GASES EVOLVING FROM WET BIOLOGICAL MATERIAL. *(Assignee not given.) U. S. Pat. 3, 572,665. 6p., March 30, 1971. 4 refs. (Appl. Oct. 14, 1969, 7 claims).*

A method and apparatus are provided for destroying odorous components of gases released from garbage and food waste plants during the receiving, storage, and by-product processing operations. Destruction is accomplished by collecting all such odorous gases and cycling them through a high temperature region, raising them to an odor-destroying temperature of about 1300 F before releasing them to the atmosphere. When wet composted material is to be dried in the plant, some of the gases are utilized in a direct contact dryer. The gases utilized in the dryer are preheated by indirect heat exchange with the deodorized gases, thus lowering the temperature of the exhausted deodorized gases to about 600 F. In catalytic systems which had been previously used, the catalysts were subject to rapid poisoning or becoming inactive. (Author abstract modified)

18107 APTIC NO. 36911

Watanabe, Shoji

MECHANISM OF REDUCTION OF SO2 IN EXHAUST GAS IN CASE OF COMBUSTION WITH FUEL ADDITIVE. *(Juyu tenkazai ni yoru nensho haigasu-chu no SO2 teigen no mekanizumu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):186, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The decrease in sulfur dioxide concentration in the combustion exhaust of heavy oil in considered to be due to the formation of sulfur monoxide by the catalytic effect of additives. The combustion experiment was carried out using sulfur powder and an additive, and the exhaust gas was analyzed by mass spectrometry, which indicated the presence of SO; however, other higher oxides of sulfur (SnOm) were unidentified. The formation of SO at combustion temperature of fuel (1500 C) is due to the catalytic effect of the activated metal produced by the thermal decomposition of an additive. The effective component of additives is an alkaline earth metal complex of organic sulfonic acid.

18108 APTIC NO. 36417

Watkins, C. H. and G. J. Czajkowski

HYDRODESULFURIZATION OF ATMOSPHERIC AND VACUUM GAS OILS. *Preprint, American Inst. of Chemical Engineers, New York, 21p., 1971. 1 ref. (Presented at the American Institute of Chemical Engineers National Meeting, 68th, Houston, Tex., Feb. 28-March 4, 1971.)*

One-third to one-half of the total sulfur in virgin residual fuel oils is present in the distillable gas oil portion. Hydrodesulfurization units processing this portion are helping to meet sulfur dioxide emission limitations. Performance data from two commercial units, one in the Far East and the other in the Western Hemisphere, show that 80-90% sulfur removal is accomplished with catalyst lives in excess of one year. The Far East Unit is designed to produce light gas oil with 0.1 wt% sulfur and vacuum gas oil with 0.18 wt% sulfur from a blend of 3000 BPSD of light oil with 0.8 wt% sulfur and 10,000 BPSD of vacuum gas oil with 1.8 wt% sulfur. The Western Hemisphere unit handles a 1.6 wt% sulfur, 630-1050 F blend of light and vacuum gas oils from several crude oils. Design throughput is 30,000 BPSD. Estimates prepared for 40,000 BPD units indicate operating costs of 23.3 cents/bbl for 1.6 wt% sulfur feed and 27.1 cents/bbl for 2.8 wt% sulfur feed.

18109 APTIC NO. 36460

Witte, Erich

HOW FAR ADVANCED ARE NEW ENERGY SOURCES FOR ELECTRICAL TRUCKS? Foerdern Heben, 19(5):295-297, 1969. 7 refs. Translated from German, 7p.

The current status of accumulators and fuel cells for electric vehicles is reviewed. Most accumulators under development are unsuitable because they contain expensive materials whose quantities are limited. Except for the heavy lead accumulator, there remain only the air-zinc accumulator and the sodium sulfide accumulator. Several years of testing have resulted in no practical application of the latter. Although their primary cells have been manufactured for decades, two essential problems exist with air-zinc accumulators: development of a suitable electrode for air intake and the dissolution of the zinc electrode during discharging. It is doubtful that the air-zinc accumulator will replace the lead accumulator on electric trucks. Work on mechanically rechargeable fuel cells is still in the initial stage.

18110 APTIC NO. 37197

Yajima, T., K. Hishida, and S. Kato

CONTROL OF THE VAPORIZED HYDROCARBON EMISSION. *(Tanka suiso ni taisuru johatsu boshi taisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):185, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Prior to the enforcement of the hydrocarbon vapor control ordinance in Tokyo, the following three control methods were proposed: Hydrocarbon vapor was adsorped on activated carbons, suitable for low hydrocarbon concentration; the adsorption efficiency by cooling and condensing the vapor before passing through the activated carbon, suitable for higher hydrocarbon concentration; the hydrocarbon vapor emitted from air vent if underground gasoline tank is returned to the gasoline truck by connecting air vent to the truck. According to the statistical estimation, the amount of hydrocarbon vapor emitted from gasoline stations in Tokyo is reduced from 15.48 to 3.47 ton/day.

18111 APTIC NO. 36528

Yamashita, K.

MEASUREMENT OF AIRBORNE PARTICULATE IN DUST CONTROLLED AREA. *(Shitsunai funjin no sokutei). Text in Japanese. Kuki Seijo (Clean Air -- J. Japan Air Cleaning Assoc., Tokyo), 9(5):41-54, Dec. 1971. 6 refs.*

Measurements of dusts were taken in a dust-controlled room using an automatic microparticle counter and a membrane filter. An air conditioner of a 45 cu m/min capacity, and 1.0 m/s wind velocity was installed in the room, and the temperature was kept at 23 plus or minus 4 C, and at humidity of 50 plus or minus 10%. A medium size clean bench was installed in the center of the room. It collected large particles by a prefilter and an electronic precipitator and collected smaller particles by an afterfilter and a high performance filter. Particle sizes from 0.3 to 10 micron were measured in 15 classes, and the index of each particle size and the time of measurement were simultaneously recorded. Indexes of the room dusts and time variance were taken when no air conditioning was used, when the air conditioner was on, when the air conditioner and the clean bench were both used, and after the conditioner was stopped. The cleanliness of the room and the standard levels were examined, and the effects of the clean bench were examined. It was confirmed by both automatic counter and the membrane filter that the number of particles increased in proportion with the distance. In the clean bench, several minute particles of sizes less than 5 micron were recognized by both methods. When the air conditioner and clean bench were not operated, relatively large number of coarse particles between 1 mm and 5 micron were detected. The measurements of less than 5 micron particles by the automatic counter and those of larger than 5 micron particles by the membrane filter could be coordinated as a series of indexes.

18112 APTIC NO. 36204

Yanagihara, Shigeru

AIR POLLUTION AND AUTOMOTIVE ENGINES (2). *(Taiki osen to jidoshayo kikan (2)). Kikai no Kenkyu (Science of Machine), 22(9):29-32, 1970. 3 refs. Translated from Japanese. Leo Kanner Assoc., Redwood City, Calif., 16p., Aug. 1971.*

Measures for reducing exhaust emissions from internal combustion engines are discussed with special reference to nitric oxide. A substantial reduction in NO appears possible by combining exhaust gas recycling with a high-temperature exhaust reactor for the oxidation of hydrocarbons and carbon monoxide. A two-stage catalytic muffler also promises to purify exhaust gas without adversely affecting engine performance. The NO is reduced by a catalyst in the first stage, after which air is admitted and the hydrocarbons and CO are oxidized. It will be difficult to lower NO levels below one gram/mile in engines other than gasoline engines. In Sterling engines, far-reaching recycling is required, and even in steam engines combustion gas temperature must be 1000 C or below. Electric engines are exhaust-free but the lead used in present batteries may exceed the amount in gasoline additives. If it is necessary to limit NO to less than five grams of nitrogen dioxide/one kilogram of fuel, the same standards should be applied to boilers and other combustion devices.

18113 APTIC NO. 36396

Yoon, Myung Cho

AIR POLLUTION ABATEMENT AND CONTROL OF AUTO EXHAUST. *(Konghai daichaik kwa charyang kwanri). Text in Korean. Taehan Vihak Hyophoe Chapchi (J. Korean Med. Assoc.), 13(12):977-982, Dec. 1970. 35 refs.*

The amount of air pollution from automotive emissons increased fourfold between 1965 and 1971. As long term abatement programs, the following technical improvements are being sought: research and development of motor energy sources, internal combustion engines, better combustion, effective air-fuel ratio, jet fuel engines, control of overflooding, better ignition system, use of special fuels. As short term technical measures, maintenance of automobiles, frequent checkups, use of excellent cars, and selection of better fuels are considered. As long-term administrative programs, the control of population growth rate in cities, traffic regulation, control of exhaust gas, city planning, and highway maintenance are discussed briefly. As short term administrative plans, monitoring of automobile operation on highways and emission gas concentration, traffic regulation, and the rationalization of regulations and standards for the air and emission gases are considered with some reference to the United States automotive emission standards.

18114 APTIC NO. 36470

Yoshimoto, Hiromu

ABOUT DUST COLLECTOR IN ELECTRIC ARC FURNACE SHOP. *(Denkiseiko kojo no shujin ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):177, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The particulate matter emitted from copper electric arc furnace consists mostly of oxides of iron, magnesium, aluminum, calcium, silicon, zinc, and manganese. The particle size of the fume emitted during the melting period was mostly one to five micron and that of the oxidation period was less than 0.1 micron. The furnace fume is aspirated into a bag filter type dust collector through a cooling tower. Using tetron or glass fiber filter, particulate matter was collected with 99% efficiency. However, for the fume escaping from the furnace opening during the charging and unloading, a dust collector has to be attached to the plant ventilation system.

18115 APTIC NO. 36183

Yushkevich, N. F. and V. A. Karzhavin

### PRODUCTION OF SULFUR FROM SULFUR DIOXIDE.

*(Poluchenlye sery iz sernistogo gaza). Text in Russian. Khim. Prom. (Moscow), vol. 2:719-726, 1926. 3 refs.*

The reduction of sulfur dioxide on charcoal and coke was studied. Theoretical treatment of the equilibrium of the process gives practically complete reduction of $SO_2$ to sulfur. In the experiment, the equilibrium was not reached on any catalyst used; thus the theoretical data could not be verified. Carbon dioxide content in the final gas was higher and that of carbon monoxide was lower than equilibrium data indicated, which is connected with formation of side products such as carbon disulfide, hydrogen sulfide, and carboryl sulfide and with the formation of carbonic acid, which is further reduced to CO. Increase in $SO_2$ flow velocity over the coal up to a limiting value at which $SO_2$ is fully reduced to sulfur prevents reaction of carbonic acid with coal. At the same time, a slight excess of $SO_2$ in the final gas prevents formation of side products. Separation of elementary sulfur from its suspension in the gas phase was done by a silent electrical discharge.

18116 APTIC NO. 36518

Zorin, L. L. and T. I. Babashkina

### RECOVERY OF TITANIUM DIOXIDE FROM FLUE GASES WITH METAL CERAMIC FILTERS.

*(Izvlecheniye dvuokisi titana iz dymovykh gazov pri pomoshchi metallokeramicheskikh filtrov). Text in Russian. Lakokrossochn Mater. Ikh Primenen., no. 4:82-84, 1971. 5 refs.*

A dry method of purification of flue gases in titanium dioxide production is proposed. A metal ceramic filter was mounted immediately after a roasting furnace. The filter was produced from a steel powder of the 0.1 mm fraction. Its design, operation, and regeneration are described. The filter was tested both in a laboratory and in an industrial setup. The results of the tests are presented. The degree of $TiO_2$ dust removal from the flue gas was 98-100%. Metal ceramic filter elements are resistant against corrosion and abrasion.

18117 APTIC NO. 36171

Zorkoczy, Gyula

### PROCESS FOR THE EXTRACTION OF SULFUR FROM GASES CONTAINING HYDROGEN SULFIDE OR SULFUR DIOXIDE.

*(Eljaras ken kitermelesere kenhidrogen vagy kendioxid tartalmu gazokbol). Text in Hungarian. (Assignee not given.) Hung. Pat. 106200. 2p., May 1, 1933. (Appl. Dec. 6, 1930, 1 claim).*

A process is described in which industrial gases, chiefly those formed during the gasification of coal, can be cleaned of hydrogen sulfide or sulfur dioxide so that the sulfur can be extracted. The novelty of the process rests upon the fact that the reaction takes place in a medium in which no socondary reactions can occur, and the fact that the sulfur thus separated is crystalline, due to the composition of the applied medium. The stack gas is washed with a liquid such as methyl alcohol, ethyl alcohol, glycerine. Benzene or toluene is added to this liquid for separating the sulfur in crystalline form. The solvent dissolves both hydrogen sulfide and sulfur dioxide and can be blended with water. Crystallization of the sulfur formed by the reaction occurring between $H_2S$ and $SO_2$ takes place during the washing process of the gas mixture. A sulfur solvent, soluble in the washing fluid, such as benzene or toluene, is added to the washing fluid before, during, or after washing.

## MEASUREMENT METHODS

18118 APTIC NO. 36088

American Foundrymen s Society, Des Plaines, Ill.

### RECOMMENDED PRACTICE FOR TESTING PARTICULATE EMISSIONS FROM IRON FOUNDRY CUPOLAS.

*10p., 1971.*

Particulate emission tests of cupola stack gases are done under varied conditions and in several different locations, depending upon the test objective. Raw gas test locations include in the cupola stack, above the charging door, in the inlet duct ahead of the dust collector, and in the catch plus the outlet loadings. Cleaned gas locations are after the dry and wet collectors. It is recommended that cupola emissions be evaluated under conditions that characterize normal or average cupola operations. The particulate matter emanating from a cupola has a wide particle size distribution range which influences the correct choice of stack testing method. Many factors influence the particulate emissions rates of a cupola system. These include the rate of cupola operation, the character, cleanliness, and method of introduction of the charge material, the type, size, and amount of coke used, the frequency, length of time, and number of periods when tuyere blast is operative or inoperative during any period, the type of metal being melted, the method and type of alloy introduction. For short run jobbing cupolas, a minimum of three dustloading test determinations was recommended. Sampling equipment consists of filtering media. Weighing, flow measuring, flushing the sampling train, velocity-volumetric tests, analysis of captured particulates, sampling trains, and sampling equipment were reviewed. The recommended procedure and test method for sampling raw particulate emissions in the cupola stack and for sampling cleaned cupola gases was outlined.

18119 APTIC NO. 36260

Fort Detrick, Frederick, Md.

### MICROBIOLOGICAL ANALYZING METHODS FOR AEROSOLS.

*1955 (?). Translated from Russian (?), 62p., March 1957.*

NTIS, DDC: AD 682557

Bacteriological and mycological methods of analyzing aerosol and aerogels are presented. During bacteriological analysis of an aerosol, determination of the general quantity of bacteria in a unit of a volume of aerosol (general dispersion) seldom limits the testing. Besides the general dispersion, the quantitative characteristic of microflora is determined. Sedimentation methods (spontaneous sedimentation, the Shafir and Krotova methods) and filtration techniques (Mironov, Milyavski, Dyakonova, and Shtrauss methods) are reviewed. Analysis of the characteristics of the microflora of the air can take three directions: determination of the sanitary-indicative microorganisms, of the presence of pathogenic microorganisms, (by mycological analysis of the aerosols) and of the presence of fungus microorganisms. The microbiological study of aerosols is also discussed, and methods of studying the entrance of aerosols into the human organism during breathing and of conducting a biological experiment in the field of aerosols are also reported. The application of dust chamber methods, dust mask method, and the intratracheal introductions of suspensions of dust particles are included. A method of obtaining artificial smoke is also reported.

**18120** **APTIC NO. 36902**

Siemens A. G., Munich (West Germany)

LASER MONITORS AIR POLLUTION. *(Laser ueberwacht Luftverschmutzung). Text in German. Umwelt (Duesseldorf), 1(6):50, Dec. 1971.*

A laser can be used for location and density determination of smoke plumes. The light impulses sent out by the laser are reflected by the smoke plume and are received by a photodiode. The light impulse (wavelength 1.06 micron, pulse duration 20 ns, peak capacity 1 MW) is reflected as echo by the smoke and dust clouds. The photodiode used for reception of the returning signal is made of Germanium. An oscillograph records the echo impulses. Data concerning the distance and density of the pollutants can be obtained. The general air turbidity also can be determined, as well as the visibility. In the near future it will be also feasible to determine the composition of the air pollutants.

**18121** **APTIC NO. 36903**

DUST MEASURING TECHNIQUE. *(Staubmesstechnik). Text in German. Wasser Luft Betrieb, 15(12):464, Dec. 1971.*

A dust collection unit has been developed which is primarily suitable for cases were a concentration of the dusts and microorganisms on a membrane filter is necessary for subsequent examination. Air is drawn by a pump through the filter at a rate 300-2000 l/hr. An automatic throughput due to the filter resistance which increases with increasing load. The evaluation and determination of the dust concentration can be carried out by gravimetry or by particle counting. Another unit, called a Gravikon, has been designed for a throughput of 15-40 cu m air/hr. It has a variable filter head for adjustment to special measurement tasks. By means of an annular slot, the entrance speed of the dust-laden air can be regulated.

**18122** **APTIC NO. 36906**

AIR POLLUTION SEEN ON TELEVISION. *(Luftverschmutzung ferngesehen). Text in German. Staedtehygiene (Uelzen/Hamburg), 22(11):267-268, Nov. 1971.*

For the monitoring of air pollution, a combined day night TV system has been developed. The system permits the monitoring of emissions to a distance of 8 km. The head of the camera contains a Vidicon camera for daylight and another camera with a single stage light amplification for twilight and night. The switch between the two cameras takes place automatically. The camera head can be manually set to a certain position, or predetermined positions can be scanned automatically in certain intervals. The received pictures can be directly viewed or stored for later evaluation. Date, hour of the day and position are put down on the picture.

**18123** **APTIC NO. 36907**

MOBILE MEASUREMENT LABORATORY FOR ENVIRONMENTAL DATA. *(Fahrendes Messlabor fuer Umweltdaten). Text in German. Umwelt (Duesseldorf), 1(6):45, Dec. 1971.*

Since the middle of May 1971, a small van with equipment for the measurement of air pollution, wind velocity, wind direction, temperature and relative humidity has been going around in West Germany. The equipment for the measurement of sulfur dioxide shall be added later. The van has been developed by a private company and is available to everybody who needs it. It can also be used for monitoring the traffic situation. The measured data are either recorded analagously with a continuous-line-recorder or are sorted on punched tapes of magnetic bands. Renting the van plus personnel costs the customer $25/hr.

**18124** **APTIC NO. 37188**

Laser Associates, Rugby (England)

MOBILE LIDAR SYSTEM. *(Fahrbares Lidar System). Text in German. Umwelt (Duesseldorf), 1(6):47, Dec./Jan. 1971.*

A mobile lidar system (light detecting and ranging) has been developed which can be used for studying the distribution of smoke plumes coming out of stacks. It can be installed on a truck so that measurements can be taken at any desired site. They can be carried out over a distance of more than 10 km with an accuracy of + or 10 m. The lidar system operates with a laser. Its light pulse is sent into the atmosphere where it is scattered by smoke particles, water droplets, and gas molecules. The reflected signal is received by a Newton Telescope and processed by a photoelectron multiplier. The intensity of the received signal provides information on the density of the scattering source. Air pollution sources can be monitored, and the cloud and haze structure can be studied. A special feature of the system is the application of two ruby laser transmitters, one of which is adjusted to the wavelength of a water absorption band of about 6943 A, while the other is adjusted to a wavelength outside the absorption band. By comparision of two successive signals returning from the atmosphere, the concentration of the water vapor present in the atmosphere can be determined.

**18125** **APTIC NO. 36801**

Agaikin, Dmitry Ivanovich, Ekaterina Nikolaevna Kostina, Vadim Fedorovich Zhuravlev, Jury Tovievich Knopov, and Vladimir Vasilievich Dorofeev

METHOD AND APPARATUS FOR THE QUANTITATIVE MEASUREMENT OF CERTAIN COMPONENTS OF A GAS MIXTURE. *(Verfahren zur quantitativen Messung bestimmter Komponenten einer Gasmischung und Vorrichtung zur Durchfuehrung des Verfahrens). Text in German. (Inst. Avtomatiki i Telemekhaniki (Tekhnicheskoi Kibernetiki), Moscow (USSR)) Swiss Pat. 506,790. 7p., April 30, 1971. (Appl. Nov. 11, 1969, 2 claims).*

A method for the quantitative measurement of certain components of a gas mixture, especially its moisture content, by adsorption with adsorbents and subsequent desorption is described. The desorption is accomplished by heating at least one adsorbent to a certain temperature where the quantity of heat supplied is the measure of the quantity of gas desorbed and where the concentration of the adsorbed gas component is derived from the measurement of the time from the start of heating till the time when the end temperature is reached. The gas analyzer consists of at least one resistance bridge the arms of which consist of resistances, and of at least one thermistor submerged in the gas to be analyzed. The thermistor is coated with an adsorbent which adsorbs the gas component to be determined. The bridge indicates the reaching of the end temperature by means of a zero device. The gas analyzer can be executed with one resistance bridge, with two resistance bridges, with a thermistor with a temperature stabilizer, with an auxiliary thermistor which heats the gas to be analyzed as well as the thermistor coated with the adsorbent, and with two resistance bridges and an auxiliary thermistor.

**18126** **APTIC NO. 36546**

Azuma, Kenkoku and Masahiro Morikawa

MEASUREMENT OF OXIDES OF NITROGEN BY IODINE PENTOXIDE METHOD. *(Gosanka yoso-ho ni yoru chisso sankabutsu no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):71, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A model of a continuous measuring instrument for nitrogen oxides in vehicle exhaust and flue gases was developed. Sample gas and oxygen (3 to 1 in volume) were run through and oxidation catalyzer, Fe2O3-MuOx on activated alumina, the temperature of which was maintained by an electric furnace at 700 C, in order to eliminate interferences from hydrocarbons, carbon monoxide, and hydrogen. Nitric oxide in the gas was oxidized to dioxide at the space velocity of 9000 reciprocal hr by iodine pentoxide in a vessel, 160 C in temperature. Nitrogen dioxide was determined by NDUV method using light with a wavelength of 300-400, millimicron in a space 160 C in temperature. When known amounts of nitric oxide and dioxide were introduced from the exhaust gas of a car when idling, the measured values showed a good agreement with the introduced amount.

18127 APTIC NO. 36373

Bentley, H. R. and J. G. Burgan

**POLYNUCLEAR HYDROCARBONS IN TOBACCO AND TOBACCO SMOKE.** *Analyst, vol. 83:442-447, Aug. 1958. 22 refs.*

A method is described for determining the concentration of 3,4-benzopyrene in tobacco and tobacco smoke condensate by using the fluorescence spectrum of the hydrocarbon. Precipitated smoke solids are extracted from glass tubes with a mixture of diethyl ether and hydrochloric acid. The combined ether extracts are separated and washed with HCl, sodium hydroxide, and water. The solution of the neutral fraction of smoke condensate in ether is then dried over anhydrous sodium sulfate, filtered, and evaporated on a steam bath. The residue is recovered by evaporation three times from successive small volumes of light petroleum; it is then dissolved in light petroleum and transferred to a column of alumina. The chromatogram is developed with light petroleum and then successively with portions of benzene-light petroleum mixtures. Each fraction is evaporated to dryness and redissolved in light petroleum. The fluorescence spectrum of each fraction is recorded and those fractions containing 3,4-benzopyrene are combined and evaporated on a steam bath. The residue is dissolved in light petroleum. The concentration of 3,4-benzopyrene is determined by the comparison on a single photographic plate of the fluorescence spectra of the unknown solution and standard solutions containing 3,4-benzopyrene in light petroleum.

18128 APTIC NO. 36445

Billard, F., J. Brion, J. Miribel, and J. Pradel

**USE OF FUMIGENS FOR THE STUDY OF VENTILATION. RECYCLING EVALUATION, MEASUREMENT OF TRANSIT TIME.** *(Utilisation des fumigenes pour l etude des ventilations. (Evaluation des recyclages, mesures des temps de transit). Text in French. Commissariat a l Energie Atomique, Saclay (France), Centre d Etudes Nucleaires, Pollut. Radioact. Milieux Gazeux, Proc. Symp., Saclay, France, 1963, p. 387-423. (Nov. 12-16.)*

Accurate quantitative methods using currently fabricated smoke generators were applied to the measurement of external recycling ratio between the ventilation systems of a building and to the measurement of transit times inside the system extracting air from a nuclear reactor. Measurements were made by means of one or several aerosol photometers giving instantaneous readings. (Author abstract modified)

18129 APTIC NO. 36185

Burch, Darrell E., John D. Pembrook, and David A. Gryvnak

**ABSORPTION AND EMISSION BY SO2 BETWEEN 1050 and 1400/CM (9.5-7.1 MICRON). (FINAL TECHNICAL REPORT).** *Philco-Ford Corp., Newport Beach, Calif., Aeronutronic Div., Environmental Protection Agency Contract 68-02-0013, Pub-U-4947, 66p., July 1971. 14 refs.*

NTIS: PB 203523

The absorption by the nu 1 (1151.38/cm) and nu 3 (1361.76/cm) bands of sulfur dioxide was studied between 1050 and 1400/cm (9.5-7.1 micron). Spectral curves of transmittance were scanned with approximately 1/cm resolution for more than 200 samples varying in temperature from about 296 K to 575 K and in pressure from 0.01 to 16 atm. The objective was to provide data on SO2 absorption and emission that are required to interpret data obtained in this spectral interval on the emission by SO2-containing smokestack exhausts. An extensive table provides information from which the emission between 1050 and 1250/cm can be calculated for temperatures between 296 K and 650 K. Water vapor absorbs and emits so strongly in the region of the nu 3 SO2 band that the band is not useful for remote sensing of smokestacks. The strengths of the two prominent bands in /molecules cm sq/cm are: nu 1, 371 plus or minus 20 times 10 to the minus 20th power; and nu 3, 3020 plus or minus 200 times to the minus 10th power. (Author abstract modified)

18130 APTIC NO. 36912

Carlon, Hugh R.

**HEATED CHEMICAL CONVERSION FILTER ASSEMBLY FOR AEROSOL ANALYSIS.** *(Dept. of the Army, Washington, D. C.) U. S. Pat. 3,566,672. 3p., March 2, 1971. 7 refs. (Appl. June 15, 1967, 2 claims).*

Nerve gas detection devices presently in use will not respond chemically to toxic agents normally encountered as an aerosol. Such detectors have included in them a chemical conversion prefilter which is designed to convert aerosol droplets to the normal gaseous agent. The conversion reaction of aerosol to vapor analog will proceed well only above or near room temperature. Therefore, in cold weather operation the aerosol laden air must be heated in order to assure conversion to the vapor analog. Unlike previous detectors, a device is described which does not require large filter areas, does not require gasketing, eliminates pressure drop across the prefilter, is easily serviced, and heats substantially only the prefilter. The surface of the prefilter element is heated by an isolated heater from the nonactive side to convert the aerosol particles on the prefilter active surface to a vapor. Previous devices required the entire air stream to be heated in order to heat the aerosol droplets, resulting in conductive losses and a waste of power.

18131 APTIC NO. 36101

Cartwright, L. C. and P. H. Kelley

**ORGANOLEPTIC EVALUATION. SENSORY PANEL TESTING CAN HELP PROTECT FOOD PRODUCTS FROM CHANGES OF AROMA AND FLAVOR IMPARTED BY PACKAGING MATERIALS.** *Mod. Packag., vol. 25:145-147, 201-202, 204, July 1952. 10 refs. (Presented at the Technical Association of the Pulp and Paper Industry, Annual Meeting, New York, Feb. 20, 1952.)*

The use of organoleptic sensory panel testing to evaluate changes in food aroma and flavor from packaging materials is discussed. Generally, as soon as a sample of packaging material is received, it is cut into pieces of suitable size to be stored in a clean, odor-free, screw-cap jar. The sample may be evaluated by smelling a freshly torn area, by smelling material that was stored in a jar for at least 24 hrs, or by rigorous tests of submersion in hot water or aging for 24 hrs at high temperature and humidity. The transfer of packaging odors to food products is then tested by a selected panal. Presence of odor is rated as just detectable, moderate, strong, and very strong. Common odors found in packaging materials are described as cardboard, paper, sweet, ink, glue, oil, musty, turpentine, solvent, and fruity. Results showed that these test procedures can be applied to evaluation of any product for any sensory effect. Results of such investigations, when correlated with other physical and chemical test data, should contribute to greater consumer acceptability.

18132 APTIC NO. 36464

Chakraborty, B. B. and Ronald Long

**GAS CHROMATOGRAPHIC ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN SOOT**

*SAMPLES. Environ. Sci. Technol., 1(10):828-834, Oct. 1967. 17 refs.*

A relatively rapid method of identifying and determining polycyclic aromatic hydrocarbons in soot samples was developed. The individual hydrocarbons are determined by programmed temperature ga chromatography using dual flame ionization detectors. Thermal conductivity detectors were used while collecting samples for subsequent identification of the separated fraction by ultraviolet absorption spectrophotometry. Peaks in the gas chromatogram are identified by comparing the relative retention times with those of pure hydrocarbons and by ultraviolet absorption spectrophotometry of the fractions separated by gas chromatography. Both normal and Hi-Pak packed columns were used. The analyses of soot from ethylene and ethane diffusion flames were given as examples. (Author abstract modified)

18133 APTIC NO. 36394

Chapoux, E. and J. Delpeyroux

FRENCH STUDIES OF POLLUTION BY MOTOR CAR EXHAUST GASES. *(Etudes francaises sur la pollution par les echappements des vehicules automobiles). Text in French. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 157-163. 2 refs. (Oct. 4-7, Paper VI/2.)*

A standard road circuit for testing car emissions was set up. Operating modes of cars fitted with engines of various capacities were tested along different circuits in Paris. Measurement methods of total emissions of the car, allowing for determination of carbon monoxide, are described. Engine cycles were studied on a chassis dynamometer. Smokemeters were also developed for studying diesel engines.

18134 APTIC NO. 36510

Colosi-Esca, Doina

CONTRIBUTIONS TO THE APPLICABILITY IN THE FIELD OF THE METHOD WITH PARADIMETHLYPHENYLENDIAMINE MEASURING HYDROGEN SULFIDE IN THE AIR. *(Contributii la aplicabilitatea in teren a metodei de determinare din aer a hidrogenului sulfurat cu paradimetilfenilendiamina). Text in Rumanian. Igiena (Bucharest), 19(10):625-630, 1970. 3 refs.*

A calibration scale for use in the colorimetric determination of hydrogen sulfide in air was obtained by successive dilutions with water of an 0.05% aqueous solution of methylene blue. The scale can be used in place of the traditional sodium sulfide scale and with H25 colorimetric determinations involving the addition of N,N-dimethyl-p-phenylendiamine and ferric chloride to an air sampler.

18135 APTIC NO. 36372

Commins, B. T., R. L. Cooper, and A. J. Lindsey

POLYCYCLIC HYDROCARBONS IN CIGARETTE SMOKE. *Brit. J. Cancer (London), vol. 8:296-302, 1954. 20 refs.*

Tobacco smoke was obtained by smoking cigarettes in an automatic apparatus designed to simulate normal human smoking. The whole of the condensable products were extracted and the neutral extract in cyclohexane was examined by chromatography followed by absorption spectrophotometry. The extract from 100 cigarettes showed absorption peaks characteristic of anthracene and pyrene and of heights corresponding to 10.2 and 9.0 micrograms, respectively. The temperatures attained in the burning end of a cigarette fluctuated between 650 and 700 C. These temperatures are sufficiently high to cause pyrolysis of simpler compounds to polycyclic hydrocarbons. (Author summary modified)

18136 APTIC NO. 36201

Davies, C. N.

THE MECHANICS OF AEROSOLS IN THE THEORY OF SAMPLING. *(La mecanique des aerosols dans la theorie du prelevement). Text in French. Preprint, Faculte des Sciences de Paris (France), p. 1-9, 1968. 13 refs. (Presented at the Seminaire de Physique des Aerosols, Paris, France, 1968.)*

Aerosol sampling is important because of the certainty whether particles approaching the orifice of a sampling device (tube) will enter at the same concentration in which they occur in the air. The objective of aerosol sampling theory is to predict the apparent concentration expressed by the ratio of the aerosol quantity collected and the quantity drawn in. A general theory is complicated and has never been formulated; only special cases have beenanalyzed mathematically. A thin-walled tube serving as a sampling device is considered. It is small if the yield is identical no matter what the orientation of the tube and large if the yield is a function of the tube s orientation. Calculations are given to indicate the required conditions for effective sampling and to define under what conditions a tube should be considered small or large. The calculations relate to a pin-point source in static air and to a tube in a current of air.

18137 APTIC NO. 36034

Dharmarajan, Venkatram and Philip W. West

MICRODETERMINATION OF CADMIUM AIRBORNE PARTICULATES BY MEANS OF THE RING-OVEN TECHNIQUE. *Anal. Chim. Acta, 57(2):469-472, Dec. 1971. 18 refs.*

None of the current methods for measuring cadmium are suitable for field applications because of the detailed sample preparation invloved and the equipment required. A new method has been developed for the estimation of cadmium by use of the ring-oven and iron (II)bipyridine iodide as the reagent. A red violet precipitate is obtained, which is characterized by the fact that both its cationic and anionic constituents are complexes. This unusual combination accounts for the remarkable sensitivity and selectivity of this test for cadmium. Interferences are inhibited by the use of suitable masking agents. The recommended procedure is presented.

18138 APTIC NO. 36440

Diamant, W.

OPTICAL METHODS IN AIR POLLUTION RESEARCH. *(L investigation optique dans recherche concernant la pollution atmospherique). Text in French. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 237-238. (Oct 4-7, Paper VII/9.)*

The mechanism of combustion was investigated as 0preliminary research into air pollution. A photomicrographic method using a revolving mirror for optical investigation within the fuel jet was used to analyze the microphenomena localized on the surface of the liquid sheet the moment it came out of the injector. The optical method was further extended to the examination of urburned solids in the flue. Experimental procedures and test results are discussed.

18139 APTIC NO. 36856

Eguchi, Tadashi and Koichi Yamashita

INSTRUMENTATION OF NOx ANALYZER BY CHEMILUMINESCENCE METHOD. *(Kagaku hakko sokko hoshiki ni yoru chisso sankabutsu sokutei sochi no shisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):74, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A model of a continuous measuring apparatus for determining nitrogen oxides was developed. Nitric oxide is determined by measuring the light intensity ranging from 5900 to 25,000 A, in proportion to the amount of nitric oxide, when excited nitrogen dioxide becomes one in the ground state in the process of the reaction between nitric oxide and ozone. Nitrogen dioxide is converted to the oxide in advance and is measured in the same way. This apparatus features rapid response (within 3 sec), good stability at lower concentrations of nitrogen oxides, linearity over a wide range, and almost no interference by other gases. A flowsheet of the apparatus is given.

18140 APTIC NO. 36861

Eguchi, Tadashi and Shinzo Tanaka

INSTRUMENTATION OF VEHICLE EXHAUST NOx ANALYZER BY SALTZMAN METHOD. *(Nafuchiruechiren jiamin-ho ni yoru jidosha haiki gasu-chu no chisso sankabutsu no jido sokuteiki no kaihatsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):70, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The naphthylethylenediamine method, which is provided in the Japanese Industrial Standards for determining nitrogen oxides in exhaust gases was improved and automated. The conventional method takes a long time to oxidize nitric oxide to dioxide; the catalytic oxidation method was found to be one of the best, especially the one using platinum silica wool. The instrumentation consists of gas metering, reagent metering, oxidation, colorimetry, and electrical control. Metering of the sample, oxidation, introduction of the agents, and recording are automatically controlled by a sequential programmer.

18141 APTIC NO. 36834

Endo, A. and T. Kimoto

MEASURING METHOD FOR OXIDANT BY ETHYLENE. *(Echirenho ni yoru okishidanto sokutei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):47, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

An instrument was developed for determining oxidants which follows the method suggested by the U. S. government in 1971. It makes use of luminescence by ethylene gas and oxidant and of the determination of ozone by means of the neutral potassium iodide method as a calibration. Its sensitivity does not change while the flow rate of ethylene is approximately 30 ml. Also, the sensitivity is linear up to a few ppm of ozone. Zero drift is within 1%. Air rate for sampling is 1.5 l/min.

18142 APTIC NO. 36285

Gillieson, A. H. and D. M. Farrell

THE DETERMINATION OF QUARTZ IN DUST BY INFRARED SPECTROSCOPY. *Can. Spectr., 16(1):21-26, Jan. 1971. 4 refs.*

Alpha-quartz was determined down to one tenth of a milligram when collected on a polyvinylidene chloride (Saran) filter, by the absorption of its characteristic peak at a wavelength of 12.5 micron. It was estimated that the limit of detection under the conditions used, was one twentieth of a milligram. Possible interferences from feldspar, mica, and pyrite were examined. According to the spectra recorded in the literature, hornblende, kaolinite, and montmorillonite might also interfere. By the use of a selective infrared detector and composite filters of polyvinylidene chloride and Irtran 2 (zinc sulfide), it is suggested that a simple nondispersive infrared analyzer for the determination of alpha-quartz dusts might be devised. (Author abstract)

18143 APTIC NO. 36119

Harden Charles S. and Peter E. Wagner

THREE-DIMENSIONAL QUADRUPOLAR MASS ANALYZER. I. GENERAL DESCRIPTION. *Edgewood Arsenal, Md., Physical Research Lab., Tasks 1B662710AD2901, 1B662708AD1802, Rept. EASP-100-93, 33p., Feb. 1971. 10 refs.*

NTIS, DDC: AD 881732

The principles of operation and general description of a three-dimensional quadrupolar mass analyzer are examined with respect to trajectories, loss mechanisms, and dynamics. Charged particles can become trapped, i.e., their trajectories can be bounded in periodic, three-dimensional, rotationally symmetric, quadrupole electric fields. The trapping can be made mass selective by the proper application of ac and dc driving voltages. This sensitive mass spectrometer possibly can be used as a detection device for trace gases in the atmosphere. (Author summary modified) 0

18144 APTIC NO. 36055

Hoegl, A.

MEASURING TECHNIQUES FOR THE DETERMINATION OF THE CONCENTRATION AND MOBILITY OF ATMOSPHERIC IONS. *(Messtechnik zur Bestimmung von Konzentration und Beweglichkeit atmosphaerischer Ionen). Elektromed. (Berlin), 8(3):148-152, 1963. Translated from German. Royal Aircraft Establishment, Farnborough (England), 12p., May 1970.*

NTIS: N71-25148

The measuring principles and the construction of Ebert ion counters for the determination of the concentration of small air ions are described. The sources of error in these devices are examined on the basis of recent investigations. A special measuring capacitor has been developed for the determination of the mobility spectrum of air ions. The apparatus was first used to measure the range of mobilities in naturally ionized air. The results showed that, in the small ion region, there was only one peak in the spectrum for positive ions and one for negative. (Author summary modified)

18145 APTIC NO. 36358

Hoffmann, Dietrich and Ernest L. Wynder

SHORT-TERM DETERMINATION OF CARCINOGENIC AROMATIC HYDROCARBONS. *Anal. Chem., 32(2):295-296, Feb. 1960. 2 refs.*

Polycyclic hydrocarbons from combustion and other materials can be enriched under separation from hydrophilic compounds by partition between cyclohexane and water. The partition coefficients for the pure polycyclic hydrocarbons between cyclohexane and methanol-water are above 13 and, therefore, the loss of polycyclic hydrocarbons after extraction of the methanol phase with cyclohexane three times is less than 1%. In the next step a distribution between the cyclohexane phase and nitromethane is employed. Partition of pure polycyclic hydrocarbons indicates that at least 60% of these compounds are found in the nitromethane phase. Thus, four more extractions are necessary to yield 99% in the nitromethane phase. After partition, column chromatography of the residue of the nitromethane extracts follows. Thirty to 40 parts of adsorbent (silica gel) per part of residue achieve sufficient separation before the final separation by paper chromatography. Analysis of cigarette smoke condensate is used as an example of the method.

18146 APTIC NO. 36858

Homma, Katsunori

MICRODETERMINATION OF SULPHURIC ACID MIST BY THE THIN METAL FILM METHOD. *(Kinzoku usumaku ni yoru ryusan misuto no biryo teiryoho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollu-*

*tion), 6(1):65, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A method to determine sulfuric acid mist in the air, using thin iron film, which reacts with the mist selectively, and a photoelectric colorimeter were developed. A chip of pure iron was evaporated in a vacuum vessel by means of electrical heating through tungsten wire to form a thin film on a cover glass which had been cleaned with ethanol using supersonics. The film thickness was adjusted so as to become equivalent to the light absorption rate of 0.05% of potassium permanganate in a vessel 1 cm thick measured at 400 millimicron. Sulfuric acid mist was collected on films thus prepared and the trace of corrosion formed was measured as the differential light transmission by a photoelectric colorimeter. A working curve was produced from the above values; the amount of sulfuric acid was determined by the titration method for the artificial mist.

18147 APTIC NO. 37159

Homma, Katsunori

MICRODETERMINATION OF ACID MIST BY THE PH FILTER METHOD. *(PH roshi ni yoru san misuto no biryo teiryoho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):64, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The pH filter paper method for determining acid mist in the air was improved in an effort to find better methods than conventional ones. Thymol blue and bromophenol blue were chosen as pH indicators f05r strong acid and for total acid, respectively. These indicators were resolved into the mixture of ethanol and water (1 to 1) to form 0.2% in concentration; 1 vol % glycerin and 0.1 N sodium hydroxide solution of 0.5 vol % for thymol blue and 4 vol % for brom phenol blue were added to improve coloring. Membrane type filter paper was immersed in this solution, washed with water, and dried. Sulfuric acid mist alters the color of filter paper thus prepared and is determined by means of a photoelectric colorimeter. A comparison between this method and conventional titration methods is shown.

18148 APTIC NO. 36840

Honma, K., K. Oikawa, K. Himi, T. Muramatsu, T. Tanaka, and R. Ogawa

THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS NO.2 COLLECTION EFFICIENCY OF THIMBLE FILTER. *(Endo haigasu-chu kinzoku seibun bunsekiyo ento roshi no tokusei, dainiho, kakushu ento roshi no ryudobetsu roka tokusei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):79, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Filtering characteristics of thimble filters for determining cadmium and lead in flue gas provided in JISK0097 were examined. Using the suction velocity for a sampling nozzle, 7.5 to 20 l/min, corresponding to 5 to 20 m/sec, flow velocity of the flue gas, the initial pressure drop and filtering collection efficiency by fineness for lead fume with a particle diameter range from 0.07 to 0.25 micron were measured. As a rule, thimble filters made of quartz glass fiber are recommended since they show lowest pressure drop and good collection efficiency. The one made of cellulose is not recommended.

18149 APTIC NO. 36833

Hosaka, Naohiro and Hiroshige Arai

ON THE MEASUREMENT OF OZONE CONCENTRATION IN THE AIR. *(Ozon no sokuteiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):48, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

In order to continuously determine ozone concentrations in the air with shorter time constants of response, a detecting cell utilizing coulometry was designed, which has a response of 17 sec (90%). Output is stable while the flow rate of reacting fluid (neutral potassium iodide) varies from 50 cu cm/hr to 120, due to the detecting cell and a bellows pump installed in the space with a constant temperature of 40 plus or minus 1 C. Furthermore, output shows good linearity for electrode voltage at 0.20 V to 0.25. This cell can be used as an oxidant meter by providing a filter which eliminates interfering substances.

18150 APTIC NO. 36894

Hoshika, Y., T. Ishiguro, Y. Shigeta, and N. Futaki

OBSERVATION ON THE BASIC INVESTIGATION METHOD FOR BAD ODOR FROM THE STANDPOINT OF ON-SITE TESTS. (A SEQUEL). *(Genjoteki keiken kara mita akushu kogai kibon chosaho ni kansuru ichi kosatsu (zokuho). Text in Japanese. Preprint, Japan Chemical Society, Tokyo, p. 229, 1971. 2 refs. (Presented at the Japan Chemical Society, Fall Meeting, 25th, Osaka, Japan, Oct. 11-14, 1971.)*

Odor sensitivity tests by the injection method, the six-stage intensity indication method, instantaneous olfactory index of pleasant and unpleasant sensations, and their correlations with equipment analyses were examined. Gas chromatography was used for equipment analyses. The staff members of the Japan Environmental Hygiene Center and their collaborators inspected control areas by an automobile. The odor of a Kraft Pulp Mill was detected within 10 to 14 km leeway. Measurements were taken by gas chromatography and by the olfactory sensitivy test 500 m from the mill with approximately 700 t/day, on a cloudy day with occasional rain, temperature 29 C, wind 3-5 m/sec. Considerable agreement was noted between the six-stage intensity indication method and the instantaneous olfactory index. Odor index was from 18 to 32.

18151 APTIC NO. 36226

Houser, Edwin A. and Richard Villalobos

ANALYSIS OF CATALYTIC CRACKER REGENERATOR FLUE GAS. *Preprint, Instrument Society of America, Pittsburgh, Pa., 8p., 1970. 2 refs. (Presented at the Instrument Society of America, National Symposium, 16th, Pittsburgh, Pa., May 25-27, 1970.)*

To optimize performance of a catalytic cracker, the unit operator needs up-to-date measurements of carbon dioxide, carbon monoxide, and oxygen in the regenerator flue gases. Although an easy application for the Process Gas Chromatograph, sample conditioning has historically been a problem because the available methods for removing catalyst dust also destroy the CO2 analysis accuracy. A new, practical sampling system using hot filtration techniques is described. An important feature of the analysis hardware is that sample injection and backflushing functions are combined on a single 10-port sliding plate valve. Argon carrier is used to mask out the argon in the sample. Analysis temperature is set high enough to prevent condensation of water in the sample. The system is reliable, has the required accuracy, and needs little maintenance.

18152 APTIC NO. 36110

Huber, E. W.

MEASURING THE TRAPPING EFFICIENCY OF INTERNAL COMBUSTION ENGINES THROUGH CONTINUOUS EXHAUST GAS ANALYSIS. *Preprint, Society of Automotive Engineers, Inc., New York, 12p., 1971. 20 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710144.)*

A practical method to conveniently determine the effective cylinder charge in an internal combustion engine through continuous exhaust gas analysis is described. Relatively simple gas concentration recorders can be used in any laboratory to measure the trapping efficiency of engines. For gasoline engines, the oxygen content of the exhaust gas is monitored and for diesel engines, n-butane is used as a tracer gas. The method can be used on 2-stroke and 4-stroke cycle engines. The theoretical basis of the method is discussed and the limits of the application are shown. Actual test results obtained with test engines, which were specially prepared for zero scavenging and for controlled scavenging with air only or with an air/fuel mixture, are given. (Author abstract modified)

18153 APTIC NO. 36438

Huenigen, E. and J. Sachse

**AN EFFICIENT METHOD AND TYPE OF DEVICE FOR MEASURING, AND A PROPOSAL FOR INTERNATIONALLY ACCEPTABLE LIMITS OF DIESEL SMOKE.** *(Zweckmaessige Messmethode und Messgeraetetyp mit einem Vorschlag international annehmbarer Grenzwerte fuer die Rauchdichte von Fahrzeug-Dieselmotoren). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air. Congr. Proc., London, England, 1966, p. 196-198. (Oct. 4-7, Paper VI/14.)*

Sixteen smokemeters were examined for efficiency and adaptiveness in measuring diesel smoke density. The amount of soot present in a given volume of exhaust gas defined diesel smoke density. In principle, the maximum point of the plotted smoke density against the number of revolutions with continuous engine output and vehicle and engine acceleration was approximately the same on all engines. Optimum detection of the maximum density under practical operating conditions on the basis of an appropriate air-hygienic rating was achieved only by transillumination of a smoke column of continuous measuring instruments for test-stand and road-side checking. Proposals for limit values of diesel smoke are presented.

18154 APTIC NO. 36862

Hussey, R.

**RECOMMENDED INSTRUMENTATION OF SMALL BOILERS.** *J. Inst. Fuel, 43(354):269, 272, 274, 276, 278, 279, July 1970. 10 refs.*

Standards of instrumentation are presented for low-pressure hot-water boilers with ratings of over 500,000 Btu/hr, and for steam boilers with ratings up to 60,000 lbs/hr. The standards of instrumentation fall into two categories: the minimum essential to enable a boiler to be operated with a reasonable degree of efficiency and, recommended extras to enable the boiler to be operated at optimum efficiency and to provide sufficient records of operating conditions to enable the economics of the operation to be assessed. Measurement of solid and liquid fuels is discussed, as well as the measurement of steam and water, temperature, flue gases, smoke density, pressure, and draught. The selection and siting of instruments is mentioned.

18155 APTIC NO. 36420

Ierokomos, N.

**ION PUMP - VOLUME 2 OF 6 COMBINED STUDY PROGRAM. (FINAL REPORT).** *Perkin-Elmer Corp., Pomona, Calif., National Aeronautics and Space Administration Contract NAS1-9469, NASA CR-111856, SPO 30006, 63p., March 1971. 2 refs.*

NTIS: N71-22870

A program was conducted in which an instrument system concept was studied to optimize the application of a mass spectrometer as a sensor for monitoring the primary atmospheric constituents, as well as atmospheric contaminants, on board a manned spacecraft. The program was divided into six individual studies representing the primary system parts complementing the spectrometer: a carbon monoxide accumulator cell, an ion pump, an ion pump power supply, an inlet leak, an ion source, and an undersea atmospheric analyzer. The design, fabrication, and testing of a flight configuration ion pump and magnet assembly for use in flight mass spectrometers are discussed in this volume. (Author abstract modified)

18156 APTIC NO. 37183

Ishii, Takeshi and Shigeru Yanagihara

**STUDY ON MEASUREMENT OF AUTOMOTIVE EXHAUSTS.** *(Jidosha haiki gasu sokutei ni kansuru kenkyu). Text in Japanese. Preprint, Ministry of International Trade and Industry Tokyo (Japan), Government Mechanical Research Lab., p. 9, 1971. (Presented at the Meeting of the Government Mechanical Research Laboratory Tokyo, Japan, Dec. 16,1971.)*

Diluted, standard, and concentrated indexes of carbon monoxide concentration in automotive exhaust gas when idling were established, and various mode operation tests were given; the influences on the composition of exhaust gas were examined. Differences in measurements of gas composition were examined by using the direct gas sampling, the total bag sampling, and the proportionate sampling methods. The influences on exhaust gas composition by the established CO concentration were recognized. The seven-mode operation was a relatively severe test method. The total bag sampling analysis yielded lower figures than the direct sampling analysis, but it was the most dependable of the three methods. The proportionate sampling analysis tended to yield even lower figures.

18157 APTIC NO. 36341

Israel, Gerhard W. and James Shiapin Whang

**DYNAMICAL PROPERTIES OF AEROSOL BEAMS.** *Maryland Univ., College Park, Dept. of Civil Engineering Air Pollution Control Office Grant R01-AP00910, Inst. for Fluid Dynamics and Applied Mathematics TN-BN-709, 123p., July 1971. 18 refs.*

The particle beam principle was employed to measure the size of submicron aerosols and to test a theory describing particle trajectories in the beam. Particle beams were generated by continuous nozzle expansion. Polystyrene latex spheres (particle diameters less than or equal to 0.126 micron to particle diameters less than or equal to 1.2 micron) were utilized as a test aerosol. The expansion nozzle was designed to provide particle flow in velocity equilibrium with the air flow inside the nozzle and leaving the nozzle parallel to its axis. The design was based on particle diameter less than or equal to 0.7 micron and a source pressure greater than 100 mmHg. The particles were collected on microscope cover glasses mounted downstream from the nozzle at points where the particle beam was already separated from the air jet. Electron microscope analysis revealed that the particles formed a disc-like deposit with rather uniform density. Calibration curves are given for the dependence of deposit disc diameter on particle size and source pressure. The results indicate that the size of the tested particles was determined with an accuracy of about five percent. The applicability of the method to determine the size distribution of unknown atmospheric aerosols from 0.1 to one micron was also demonstrated. Calculated particle trajectories were in good agreement with the experiment. The trajectories were calculated downstream from the nozzle using the characteristics for supersonic flow. Stokes drag was assumed for the interaction between gas flow and particles. Some results are presented on the beam-forming characteristics of capillaries and conical nozzles.

18158 APTIC NO. 36544

Ito, Eiiti, Masaru Kitase, and Kiyoshi Kubo

**ON MEASUREMENT OF CARBON DISULFIDE AROUND A FACTORY.** *(Hasseigen kojo funkin ni okeru CS2 nodo oyobi sanpuringu-ho no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):76, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Due to the odor from a cellophane manufacturing plant, the concentration of and sampling methods for carbon disulfide, which may be its cause other than hydrogen sulfide were examined. The concentration of carbon disulfide decreases rapidly from the source, and becomes almost none around 500 m from the source. The effects of two sampling methods where the absorbing agent is added to a sampler which contains the collected air and where the air is reacted with the agent while it runs through a small absorption tube at the rate of 0.5 l/min, are examined with respect to stability of color and the efficiency of absorption.

18159 APTIC NO. 36498

Izumikawa, S., K. Nakano, and T. Odaira

DISCUSSION OF NEUTRAL KI METHOD FOR OXIDANT. *(Chusei yoka kariumu-ho ni yoru ozon (okishidanto) sokutei ni tsuite no mondaiten). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):50, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The neutral potassium iodide method is not a characteristic reaction of ozone; other organic peroxides, nitrogen dioxide, chlorine, and hydrogen peroxide in the atmospheric also react similarly. The type of interfering substances and the degree of effect on ozone measurement were investigated. Iodine liberated by the KI method is quantitatively reduced by sulfur dioxide and hydrogen sulfide in the atmosphere, and the negative effect of such gases was studied. The efficiency of chromium trioxide sulfuric acid filter used for the removal of SO2 and side effects on other gases were also investigated.

18160 APTIC NO. 36178

Julian, Alain

STUDY OF VARIOUS APPARATUS FOR THE DETERMINATION OF ALTITUDE OF AEROSOLS. *(Etude des differents dispositifs de prelevement en altitude des aerosols). Text in French. Paul-Sabatier Univ., Toulouse (France), Thesis (Ph.D.), 1970, 86p. 33 refs.*

NTIS: NP 18633

A study of the vertical distribution of long-lived radioactive elements and of stable elements has necessitated a detailed investigation of sampling devices. The interest in the elements studied, beryllium-7, phosphorus-32, strontium-90, lead-210, polonium-210, sodium, bromine, iron, phosphorus, manganese, and chlorine, is reviewed, together with the previously used measurement methods. Filters are studied, and calculations of flow rates are resolved. Experimental results, operating variables, and calibrations are included. Neutron activation analysis was used to determine the concentration of aerosols.

18161 APTIC NO. 36069

Katz, Morris

PHOTOELECTRIC DETERMINATION OF ATMOSPHERIC SULFUR DIOXIDE EMPLOYING DILUTE STARCH-IODINE SOLUTIONS. *Anal. Chem., 22(8):1040-1047, Aug. 1950. 19 refs. (Presented at the U. S. Technical Conference on Air Pollution, Washington, D. C., May 3-5, 1950.)*

Dilute solutions of starch-iodine were found suitable for the continuous determination of low concentrations of sulfur dioxide in smelter areas where hydrogen sulfide is not likely to occur. The most effective concentration range of solution is from about 0.00007 N to 0. 00002 N. The apparatus for the continuous recording of SO2 consists of a Thomas analyzer, two gas bubblers containing 100 ml of solution mounted in a block with a light source between them, and two photoelectric cells. The output current is passed through a standard resistance box and the voltage drop across the 0 to 500-ohm terminals is measured by a potentiometer with a scale range of 0 to 50 mv. The instrument has a range of less than 0.01 to 1.00 ppm or more, depending upon the size of the gas sample and the volume of solution used in the absorbers. It was used for several seasons to determine the SO2 content of the air at a location in the Sudbury smelting district. Comparative tests of the iodine and hydrogen peroxide conductivity methods were made with a portable apparatus on simultaneous samples of air in the path of the smelter fumes. The results indicate that a substantial fraction may consist of sulfur trioxide, sulfuric acid, or sulfate. (Author abstract modified) 0

18162 APTIC NO. 36860

Kiyama, A., S. Tazawa, and Y. Kubo

EFFECT OF O2 CONTENT ON NO DETERMINATION IN FLUE GASES. *(Endo gasu-chu NO sokutei ni okeru O2 nodo no eikyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):68, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Although the naphthylethylenediamine method, which is provided in JIS K0104 as a means to determine nitric oxide in flue gases uses values of two-hour oxidation by air, its oxidation efficiency is insufficient for smaller concentrations of nitric oxide. Therefore, the use of oxidation by oxygen is suggested. Since the oxidation efficiency can be calculated from the reaction rate constant between nitric oxide and oxygen, and the conditions of oxidation, such as initial concentration of nitrogen dioxide and oxygen and oxidation time, it was compared with the oxidation efficiency by air; more than 95% of the oxidation efficiency was found for oxidation by oxygen, whereas air oxidation showed 80% efficiency.

18163 APTIC NO. 36901

Kogan, Abraham

METHOD AND APPARATUS FOR MEASUREMENT OF CONCENTRATION OF A GAS IN A GAS MIXTURE. *(Assignee not given.) U. S. Pat. 3,566,673. 3p., March 2, 1971. 6 refs. (Appl. Feb. 28, 1968, 13 claims).*

A method and apparatus are presented for measuring the concentration of a gas component in a mixture of gases. The method utilizes the principle that the molar flow rate of a gas discharged from a chamber through a restricted passage under choked flow conditions will be proportional to the pressure in the chamber and independent of the downstream pressure. The gas mixture is introduced into a first chamber and discharged through a restricted passage under choked flow conditions, and the gas component whose concentration is to be determined is then isolated by freezing the other gas component or by use of an adsorbent material. The isolated gas component is then introduced into a second chamber and discharged again through a restricted passage under choked flow conditions. The concentration of the separated gas in the gas mixture can then be determined from the ratio of the pressure in the second chamber to the pressure in the first chamber.

18164 APTIC NO. 36182

Kolikovski, P., V. Velickova, and E. Lambreva

ON THE QUESTION ABOUT THE PRACTICAL APPLICATION OF THE INDICATOR TUBES. *(Po vuprosa za prakticheskoto prilozheniye na indikatornite metodi). Text in Bulgarian. Khig. Zdraveopazvane, 2(5):490-497, 1969. 17 refs.*

Following a survey of the literature, an in-depth analysis was made of the advantages and disadvantages of indicator tube determinations. Serial analyses with indicator tubes will give better results than classical methods with respect to the mean whole day concentrations for a specific toxic agent. The detection of carbon monoxide is discussed.

18165 APTIC NO. 36826

Kolmeschate G. J. van and Vos R. H. de

MERCURY IN THE ENVIRONMENT - TECHNIQUES OF ANALYSIS. *(Analysetechnieken voor kwik in het milieu). Text in Dutch. TNO Nieuws, 26(7):415-418, July 1971.*

Methods of analysis of mercury are divided into two categories: those which determine the total mercury content and those which specify the organic mercury compounds. A classical method of determining total mercury content is the spectrophotometric dithizon method. This is described with examples. The other methods are atomic absorption and neutron activation analysis. For the organic mercury compounds, gas chromatography is used. Research institutes are mentioned. As a detection system, the electron capture detector is very suitable for routine analysis. Neutron activation analysis is speedy, accurate, and very adaptable to remote control on large scale applications.

18166 APTIC NO. 36383

Kothny, E. L. and P. K. Mueller

SUB-MINUTE CONTINUOUS NITROGEN DIOXIDE ANALYSIS. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 182-184. 8 refs. (Oct. 4-7, Paper VI/9.)*

The feasibility of azo-dye reagents for high-speed recording of nitrogen dioxide concentrations is examined with respect to colorimetric reaction mechanisms, performance parameters, experimental procedures, reagent formulation, and analyzer design. The effect of chemical and physical variables on the response of the nitrite reagent was investigated. The fast-response reagent developed contained N,N(1-naphthyl, acetyl) ethylene diamine, 2-amino-p-benzenedisulfonic and sulfuric acid. Gas-liquid contact and optical systems were evaluated to match the reagents. Spectrophotometry, Saltzman reaction, and other colorimetric reactions are mentioned. (Author abstract modified)

18167 APTIC NO. 36468

Koyama, I., T. Odaira, T. Ishiguro, A. Kobayashi, Y. Fukushima, and Y. Iwasaki

EVALUATION OF ODOR POLLUTION. *(Akushu kogai no hyoka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):179, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The bad odors from a 30 ton/day fish-meal plant and a 40 ton/day bone-meal plant were detected within 500 m and 1.0 km range, respectively. The atmospheric dispersion of odorant was not uniform and the odor reached as far as 2.0 km, depending on the container at their source remained unchanged for a period of several hours. The odor measurement at the field was extremely difficult, and comparative experiments in an odorless chamber were necessary. The mixing of two bad odors further intensified the offensiveness of the odor. The evaluation of odor pollution by means of the odor intensity or odorant concentration is still quite insufficient.

18168 APTIC NO. 37205

Kubo, Y., S. Tazawa, M. Miki, and T. Aizu

ATMOSPHERIC SULFUR OXIDES DETERMINATION BY ATOMIC ABSORPTION METHOD. *(Genshi kyuko kodoho ni yoru taikichu zen-iosankabutsu sokuteiho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):60, 1971. 1 ref. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A method to determine atmospheric sulfur oxides by means of atomic absorption photometry was tested. Sampled air was led into dilute oxygenated water. Then hydrogen peroxide was removed from the sample by heating the sample in an infrared type drier at approximate 160 C for one hour to reduce its volume to one-fifth of the original in order to prevent its interfering with the operation. Chromate ion was separated from the sample by following the method of JIS-KOIO 1 by adding barium chromate suspension to the suspension, followed after 2 to 3 min by the addition of liquid ammonia and ethanol. After mixing, the sample was filtered through a millipore filter. The filtrate was analyzed by atomic absorption photometry. An example of the measurements is shown with a comparison with the pararosamiline method. 0

18169 APTIC NO. 36303

Kurczatowa, G.

MODIFICATION OF THE PHENOL-HYPOCHLORITE METHOD OF AMMONIA DETERMINATION IN ATMOSPHERIC AIR. *(Modyfikacja metody fenolopodchlorynowej oznaczania amoniaku w powietrzu atmosferyczznym). Text in Polish. Roczniki Panstwowego Zakladu Higi, 22(3):289-294, 1971. 21 refs.*

A modification of the phenol-hypochlorite method of determination of the ammonia concentration of the air was elaborated, the sensitivity of which is 0.1 microgram in 5.0 ml. The preparation of reagents and standard solution and photocolorimetric determination of ammonia using calibration curves are described in detail. Hypochlorite reagent was prepared by dissolving in chlorine-saturated water. When sodium chloride is added to hypochlorite and salicylic acid to phenol as stabilizers, reagents can be stored in a cool dark place for up to six months. The effect of various compounds disturbing the ammonia determination is discussed. The limiting concentrations of the most frequent atmospheric pollutants at which the ammonia determination is not yet disturbed are discussed. Practical testing of the method showed that it gives accurate and reproducible results.

18170 APTIC NO. 36824

Kuroda, Daisuke

PROBLEMS OF TOXIC GAS SAMPLING. *(Yugai gasu no sanpuringu ni okeru nondaiten). Text in Japanese. Kogai (Hakua Shobo) (Public Nuisance), 6(6):362-372, Nov. 1971. 10 refs.*

When gases are collected by dependable methods, the difference in the methods of analyses can be adjusted, and accurate data can be obtained. If the same analytical method is applied but the sampling methods and conditions are different, the results are meaningless. From this point of view, various methods of sampling and gas analysis are discussed. Absorption methods, adsorption methods, and condensation methods are reviewed. Selecting of methods of sampling depends on emission sources, locations, co-existing elements, dusts and mists, gas temperature and pressure, fluctuation of emission, and concentration. The materials for sampling equipment, the method, the time, the location, and the frequency of sampling are then determined. When sampling of a pollutant is not possible by a normal method, a pretreatment is given. Nitric oxide is oxidized and changed into nitrogen dioxide before sampling. Methods of preparing standard gases, adjusting results, and storing sampling materials are reviewed.

18171 APTIC NO. 37194

Kuroda, Daisuke

QUANTITATIVE ANALYSIS OF NITROGEN OXIDES IN ATMOSPHERE. REPORT NO.6. NO PLUS NO2 COLLECTION BY ALKALINE ABSORBENT. *(Taikichu no chisso sankabutsu no teiryo (dairokuho), arukari kyushueki ni yoru NO purasu NO2 no hoshu). Text in Japanese. Preprint, Japan Chemical Society, Tokyo, p. 230, 1971. 1 ref. (Presented at the Japan Chemical Society; Fall Meeting, 25th, Osaka, Japan, Oct. 11-14, 1971.)*

According to the Japanese Industrial Standard 0104 method, the ammonia solution absorption test of a nitric oxide and nitrogen dioxide mixture is supposed to yield a 0.5 conversion rate to nitrite ion. Results of actual experiments were different; therefore, conversion rates were measured under various conditions and the causes for the discrepancy were examined. The NO, NO2, and NO plus NO2 test gases were each taken into a glass injector of 100 ml capacity and 20 ml of absorbent was added. After 24 hr, 50 ml of the test materials was each transferred to a flask, and cleansing liquid was added. Using part of this solution, nitrite ion concentration was measured. Another part of the solution was oxidized by potassium permanganese and nitrate ion was measured. The conversion rates of NO, NO2, and NO plus NO2 were 0.21, 0.28, and 0.18, respectively when 0.1 N sodium hydroxide was used, and 0.18, 0.20, and 0.21 when 0.1 N ammonium hydroxide was used. When the temperature of absorbents was changed to 17, 25, and 30 C, both absorbents showed a lower conversion rate with the rise of the temperature. When pH was increased, the conversion rate increased. The increase rate rose regularly up to pH 12, and thereafter rose drastically. In all cases, the ionization rate was between 0.2 and 0.3, considerably smaller than the theoretical figure of 0.5. New formulas are presented.

18172 APTIC NO. 36416

Langer, Gerhard

EVALUATION OF NCAR ICE AND CLOUD CONDENSATION NUCLEUS COUNTERS. *International Union of Geodesy and Geophysics, International Commission of Cloud Physics, Intern. Conf. Condensation Ice Nuclei, 7th Prague, Czechosolovakia - Vienna, Austria, 1969, p. 288-292. 18 refs. (Sept. 18-24.)*

The National Center for Atmospheric Research Ice Crystal Nucleus Counter and Cloud Condensation Nucleus Counter, each of which uses an acoustic sensor, were em

18173 APTIC NO. 36256

Leroy, B.

AIRCRAFT OZONOMETER. *(Ozonometre embarquable). Text in French. Mes. Regul. Automat. (Paris), 35(6):77-81, June 1970. 4 refs.*

A new chemical ozonometer representing an improved version of a device developed in 1953 by the Atmospheric Physics Laboratory of the Faculte des Sciences de Paris is described. The method utilizes the reaction of ozone with potassium iodide and water yielding oxygen, potassium hydroxide, and iodine; the latter is determined potentiometrically with sodium hyposulfite, converting it quantitatively to sodium iodide. The air is drawn by a pump into a wash bottle where it bubbles through a fixed quantity of hyposulfite. When this quantity is used up free iodine depolarizes a platinum electrode submerged in the solution. A potential difference appears, which, after electronic amplification, indicates the ozone value. Two new models have been constructed, a laboratory model and an aircraft ozonometer; both are smaller, and thus less cumbersome, and more precise and reliable than the preceding model which already included the important improvement of an electromagnetic valve for filling and draining the test solution. The electronic measurement circuit comprises electrodes, a detector of the end reaction, automatic controls, a solution-proportioning device for intermittent testing, and a glass reservoir for the test solution. The principal advantage besides compactness, ease of handling, and increased sensitivity is the reduction of a single measurement time to two minutes.

18174 APTIC NO. 36479

Lutz, M. and D. Massimono

PRELIMINARY STUDY OF RAPID CHROMATOGRAPHIC ANALYSIS OF THE PERMANENT GAS CONSTITUENTS OF AIR. *(Etude preliminaire de l analyse par chromatographie rapide des gaz permanents de l air). Text in French. Methodes Phys. Anal., 6(4):384-391, Dec. 1970. 11 refs.*

Separation of argon, krypton and xenon was studied on a capillary column filled with molecular filters. Influences by injected gas supply and volume on retention times are discussed. Curves are plotted also for oxygen and nitrogen separations. Separation tests on non-capillary columns filled with activated carbon dispersed on glass-wool, and on capillary column containing activated carbon are described. Reproducibility of rapid gas chromatographic analyses was studied in test series for various gases. Due to the high speed of analysis, errors of measurement can easily be determined by statistical calculations. The method can be used in optimizing radioactive isotopes analyses, and in dynamic control analysis of reactor in chemical industry.

18175 APTIC NO. 36857

Matsumura, Yoshimi

SOME PROBLFMS ON THE CHEMICAL ANALYSIS OF SULFURIC ACID MIST. *(Ryusan misuto no kagaku bunsekiho no mondaiten). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):63, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Two problems on the chemical analysis of sulfuric acid mist were examined. First, the extraction efficiency of sulfate from filter papers for collection into pure water was investigated: 4 cellulose, 5 glassfiber, and 4 membrane filters were examined on their effect on pH of pure water and on their extraction efficiency by 3 different procedures. Existing chemical analysis of sulfate and sulfuric acid were examined on range of detection, accuracy, and interfering metals.

18176 APTIC NO. 37215

Matsushita, Hidetsuru and Keiichi Arashidani

SHORT TERM DETERMINATION OF BENZO(A)PYRENE IN TARRY MATERIALS. *(Tarujo busshitsu chu no bentsu (a) piren no kani bunsenkiho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):55, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Benzo(a)pyrene in tarry materials was determined using thin-layer chromatography and fluorimetry. The tar sample dissolved in benzene was separated using thin-layer chromatography consisting of alumina and acetyl cellulose double layers by the multiple development method. Benzo(a)pyrene spots were located by ultraviolet radiation (365 millimicron) on acetyl cellulose layers. The absorbent containing the spot was removed, eluted with benzene, and determined by fluorimetry according to the narrow base line method. The benzo(a)pyrene content in some samples was 1020 ppm.

18177 APTIC NO. 36545

Mitani, Kazunori

THE STUDY OF THE MEASUREMENT OF NITROGEN OXIDES IN AIR. *(Kichu chisso sankabutsu no sokuteiho ni kansuru kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):73, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Oct. 27-29, 1971.)*

Using diluted standard nitrogen dioxide gas, ozone, and air, the Saltzman method for determining nitrogen oxides in air was examined, in comparison with a method provided in the public Health Test Methods (Eisei Shiken Hoh), in which 0.01 N sodium hydroxide, 1% sulfanilamide-hydrochloric acid solution and 0.1% N-1 naphthylethylenediamine solution are used as agents. Findings showed that 130th N-1 naphthylethylenediamine, which is an ingredient of the Saltzman agent, and reductive substances increase the rate of absorption of nitrogen dioxide. When oxidative gas, such as ozone, exists with nitrogen dioxide, the Saltzman method gives lower values.

18178 APTIC NO. 37157

Mori, Masaki and Shonosuke Ito

AUTOMATIC ANALYZER FOR OXIDE OF NITROGEN IN STACK. *(Haigasu-chu no NOx renzoku benseki* *sochi). Text in Japanese. Taiki osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):69, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Since both the naphthylethylenediamine and phenoldisulfonic acid method, which are provided in JIS K0104 for determining nitrogen oxides in stack gases and vehicle exhaust gases are known to take time to get results, a new method was developed. Sample gas is led into a cell for colorimetry, to which oxygen is introduced up to 3 to 5 kg/sq cm in order to oxidize nitric oxide to dioxide in 2 to 5 min. Since nitrogen dioxide has an absorption band near the ultraviolet range, the amount of nitrogen oxides can be determined by measuring the light absorption rate. Oxidation rates at smaller concentrations of nitric oxide are low. In order to improve the oxidation rate, heating at 40 to 50 C and oxygen pressure at 3 to 5 kg/sq cm are applied. Sulfur dioxide and ammonia do not affect this method.

18179 APTIC NO. 36916

Nagai, Takeshi, Tomo Hattori, Takao Nagano, and Yoshifumi Ukijima

STUDY OF THE INFLUENCE OF HYDROGEN SULFIDE (I). A SIMPLE METHOD FOR THE HYDROGEN SULFIDE PAPER BADGE. *(Ryuka suiso no eikyo ni kansuru kenkyu daiippo, kenchi bacchi ni yoru ryuka suiso no kani sokutei. Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6 (1):77, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A simpler and less expensive, although less accurate, method than conventional ones to determine hydrogen sulfide was developed. Filter papers were immersed in solutions of different concentrations of silver nitrate, lead nitrate, and lead acetate and solutions alkalized with ammonium carbonate and dried in air When these papers were exposed to hydrogen sulfide of 4.25 ppm for one hour, papers immersed in 5% lead acetate solution (without alkalization) gave best result. In addition, this lead acetate paper gave a distinct change in color with hydrogen sulfide concentration changes, had good reproducibility of color, and were not disrupted by methyl mercaptan, sulfur dioxide, and direct sunlight.

18180 APTIC NO. 36905

Nakamura, Keigo and Hironori Haneda

AUTOMATIC MEASURING APPARATUS OF SO3 MIST IN AIR. *(Taikichu no ryusan misuto renzoku sokutei sochi no shisaku ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):59, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A model apparatus for automatically measuring sulfur trioxide in air was developed, in order to investigate the behavior of sulfur oxides. Dust was filtered through a cylindrical filter paper of quartz filter heated at 200 C; sampled air was let into a mist catcher (a spiral, 80 mm in diameter of glass tubing 6 mm in diameter and 1500 mm long), installed in a vessel of constant temperature of 90 C, at the rate of 10.5 l/min for 171 min. Sulfur trioxide thus collected was washed by 10 to the reciprocal 4th power N sulfuric acid and the ratio of electroconductivity before and after washing was determined in a vessel of constant temperature of 60 C. It measuring range was 0 to 2 pphm and 0 to 5 pphm. A flowsheet of this apparatus is given.

18181 APTIC NO. 36888

Nelson, Gary O. and Edward G. Shapiro

A FIELD INSTRUMENT FOR DETECTING AIRBORNE HALOGEN COMPOUNDS. *Am. Ind. Hyg. Assoc. J., 32(11):757-765, Nov. 1971. 15 refs.*

A field instrument for continuously measuring the concentration of halogens and halogenated hydrocarbons was developed. The principle of operation is based on the spark spectral increase which occurs in the presence of halogen. The degree of spectral enhancement depends on the concentration of halogenated material present. The instrument can be zeroed in on a contaminated atmosphere and has a detection limit of several parts per million for most chlorinated materials. This lightweight (13 lbs) ac-powered instrument has a 50 mv recorder output, a choice of four ranges, and a full-scale response time of 3-5 sec. (Author abstract)

18182 APTIC NO. 36839

Nukada, Masami, Akira Suzuki, and Tomoharu Nashima

DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (I) DECISION AND STABILITY OF STANDARD VALUE OF CALIBRATION GASES. *(Taiki osen sokuteiyo kosei gasu ni kansuru 2.3 no chiken (sonoichi), kosei gasu no hyojunchi no kettei oyobi sono anteido ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):80, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Two factors influencing the standard value of calibration gases used for gas analyses of air pollution were examined. In order to more accurately determine the standard values of calibration gases, the first standard value is determined by measuring the weight of each component of the gas and calulating the ratio of gas composition from the weight ratio, since it enables the elimination of correction terms of pressure and temperature. To obtain stability of the standard value, a different approach is necessary for each gas. Carbon dioxide requires homogeneity of mixing, and nitrogen dioxide has to be contained in stainless steel or iron vessels and the temperature has to be watched for condensable components, such as propane and propylene.

18183 APTIC NO. 36095

Oblaender, Kurt

THE ETERNAL AUTOMOBILE EXHAUST PROBLEM. *(Das ewige Abgasproblem beim Automobil). Text in German. Automob. Rev., (Bern), no. 44:35-37, Oct. 1969.*

Maximum allowable concentrations of carbon monoxide and hydrocarbons in automobile exhaust gases, valid for all states in the U.S., were published early in 1968. The standards are established in four categories depending on the piston displacement, and vary from 2.3 to 1.5% CO and from 410 to 275 ppm HC. In connection with the problem for a drastic reduction of CO and HC emissions, the methods of exhaust gas analysis are of great interest. One is the heat conduction method, employing an electric bridge circuit. One branch of the bridge is a platinum wire spiral which is moderately heated by an electric current and exposed to the exhaust gases. Depending on the heat conductivity of the gases the temperature of the platinum wire will drop, thus changing its electric resistance which is shown on an instrument and used as an indication of the total concentration of CO and HC. In a second method, the heat toning method, the platinum wire is brought to a higher temperature by exposing it to the heat generated by catalytic combustion of the exhaust gases with excess oxygen. Based on the calorific values of the CO and HC components, the recorded temperature rise of the platinum wire is used to determine the total content of the two gases. With a third technique, ultrared absorption method, all exhaust gas components except CO are optically filtered out, leaving only CO to be exposed to infrared rays in parallel with a reference gas which, unlike CO, does not absorb these rays. The difference in light intensity after passage of the rays is recorded and utilized for defining the CO content. Possibilities for reducing automotive emissions by afterburners and by modified conditions of ignition, combustion, fuel-to-air ratio, and choice of fuel are described.

**18184** APTIC NO. 36841

Oikawa, K., K. Himi, T. Muramatsu, T. Tanaka, K. Honma, and R. Ogawa

THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS. NO. 1 STUDY ON THE IMPURITY METAL IN THIMBLE FILTER. *(Endo haigasu chu kinzoku seibun bunsekiyo ento roshi no tokusei, daiippo, kakushu ento roshi no kinzoku seibun ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):78, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Thimble filters of three different materials (which are presented in JISK0097 for the analysis of cadmium and lead in flue gas) were examined in order to meet the requirement that they should include the least possible metals as impurities). Cellulose fiber, available for chemical analysis, borosilicate glass fiber and silica glass fiber were examined. The second and last ones are made after treating both glass fibers with dilute hydrochloric acid for one full day. Metal ingredients in these filters were analyzed by means of atomic absorption spectroscopy after low temperature ashing and heated extraction by hydrochloric acid and oxygenated water of the filters. Physical properties, such as weight, thickness, air penetration rate, tensile strength, and yield stress were examined.

**18185** APTIC NO. 36832

Okita, Toshiichi, Ikuo Watanabe, Sekio Ihara, and Masataka Sofuku

DETERMINATION OF PAN. *(PAN no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):45, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A method to determine a standard peroxyacetyl nitrate gas necessary for measuring PAN by using gas chromatogrpahy with ECD is introduced. PAN gas can be produced by photochemically oxidizing ethyl nitrite through the application of ultraviolet rays. In an acrylic, air-tight vessel equipped with an ultraviolet ray lamp and silica gel, a gas cell for an infrared spectrophotometer is filled with oxygen and then supplied with microliters of vapor released from ethyl nitrite at 15 min intervals, while applying ultraviolet rays. After approximately 1.5 hr, gas concentration of PAN can be determined by means of infrared spectrophotometry using special bands at 5.76 micron and 8.60 micron.

**18186** APTIC NO. 37158

Okita, Toshiichi

DETERMINATION OF SO2 AND NO3 USING BARRINGER SPECTROMETER. *(Barringer sokan supekutorometa o mochiita kojo chitai ya kazan kara no SO 2 oyobi NO2 no hassei kyodo no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):67, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A spectrometer developed by Barringer was applied on a trial basis to determine the emission rate of sulfur dioxide and nitrogen dioxide. The emission rate for a rectangular area can be calculated if the length of a side, from which the wind blows into the area, wind direction and velocity, and the average concentration and thickness of gases, are known. The last two can be determined by the spectrometer directed vertically. An example of the emission rate of sulfur dioxide and nitrogen dioxide in an industrial region of Kawasaki city is given. Similar measurements for the Mihara volcano in Ohshima-island gave 1420 l/sec in sulfur dioxide concentration. When the emission rate of sulfur dioxide from stacks was measured from a horizontal direction, lack of intensity of ultraviolet rays and decrease in light by particles disrupted the measurement.

**18187** APTIC NO. 37212

Okita, Toshiichi, Maki Inugami, and Masaki Mori

DETERMINATION OF OZONE USING CHEMILUMESCENCE. *(Kagaku hakko o mochiita ozon jido kirokukei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):49, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

An automatic ozone concentration recorder based on the chemiluminescence by the reaction of ethylene and ozone was developed. A description is given with a schematic diagram. The results of operational tests and field tests are reported. The calibration curve was made by the neutral potassium iodide method. The results of comparative tests on the base line drift, effect of oxidants, and ozone concentration are also reported.

**18188** APTIC NO. 36904

Oomichi, Sadao and Hiromi Uno

DETERMINATION OF SULFURIC ACID AEROSOL IN SUSPENDED PARTICULATE. *(Fuyu ryujobutsu-chu no ryusan earozoru no sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):62, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

In order to find out a better method to determine sulfuric acid aerosol than conventional indirect methods, a new method was tested. Sulfur trioxide, collected through a high-volume air sampler, was Oregenerated in the gaseous state through heated decomposition with various heating temperatures and was analyzed by the West-Gaeke and the electroconductivity methods. This method gives approximately 0.5 micrograms of sulfur trioxide out of 0.05 to 0.1% of collected sample. An example of the relationship between the sulfur trioxide determined, the time of regeneration, and the heating temperature is presented.

**18189** APTIC NO. 36133

Purdue, Larry J. and Richard J. Thompson

A RAPID SENSITIVE METHOD FOR THE CALIBRATION OF PERMEATION DEVICES. *Preprint, Environmental Protection Agency, Research Triangle Park, N. C., 8p., 1971. 4 refs.*

A rapid weighing technique that employs a recording microbalance for dynamic determination of weight loss is described for calibrating permeation tubes, microbottles, and similar devices that are used to calibrate air pollution measuring systems. The time required for calibration of permeation devices that emit gases at very low rates is reduced significantly; the technique also makes possible the use of devices charged with nitrogen dioxide and other systems for which the permeation rate in nonlinear.

**18190** APTIC NO. 36066

Repphun, W. F.

GENERAL MOTORS MOBILE EMISSION LABORATORY. *Preprint, Society of Automotive Engineers, Inc., New York, 7p., 1971. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710171.)*

The trailer of the mobile General Motors Emission Laboratory is 40 ft long, eight wide, and 12.5 ft high. The control room, which was designed for maximum operator space and sufficient room for the test vehicle, is located in the back of the trailer with the floor over the dynamometer. The front section of the trailer houses all the service equipment such as electrical power generators, air compressor, air conditioning, and lavatory facilities. The mobile laboratory is pulled by a tractor powered by a V-8 diesel engine; this tractor-trailer combination is driven to a test site, where the mobile lab is fully operational in one to two hours, depending on the level of the terrain. A temperature-controlled area allows testing regardless of outside weather conditions. Both concentration and mass emission testing can be conducted with sufficient flexibility to adapt to future emission standards. Primary applications include customer car field surveillance and assistance to assemble plant emission testing.

18191 APTIC NO. 36203

Rigdon, Lester P. and Richard W. Crawford

AN EXPERIMENTAL SYSTEM FOR DETERMINING NITROGEN OXIDES IN AIR. *California Univ., Livermore, Lawrence Radiation Lab., Atomic Energy Commission Contract W-7405-Eng-48, UCRL-51057, 14p., June 15, 1971. 13 refs.*

NTIS: UCRL-51057

The efficiency of Hochheiser and Saltzman scrubbing solutions for removing nitric oxide and nitrogen dioxide from air was studied with apparatus that included a dyanamic gas-calibration system designed to deliver 1.5 to 1500 ng/min of NO and/or NO2; a continuous gas-absorption and analysis system; and static and dynamic scrubbers. The gases were passed through the static scrubber to the dynamic scrubber and from there to a scrubbing coil for dynamic colorimetric analysis. Efficiency of the Saltzman solution for the conversion of NO2 (10-1000 ppb) to diazo dye was 72%. The solution is not satisfactory for field use, as both the reagent and the diazo dye are unstable over long periods of time. Efficiency of the Hochheiser solution in converting NO2 gas to the nitrite ion was about 35 plus or minus five percent for 24-hr sample collection. The solution initially converted 50%-80% of the NO2 to NO2(-) and/or NO3(-), then slowly decreased to about 30%. Future work will involve the study of xenon trioxide (Xe03) and osmium tetraoxide (OsO4) in basic solution. Preliminary studies in dicate that these strong oxidants can improve the efficiency of Hochhesierlike solutions.

18192 APTIC NO. 36887

Sachdev, Sham L., J. P. Lodge, Jr., and Philip W. West

SPECIFIC METHOD FOR THE DETERMINATION OF ZONE IN THE ATMOSPHERE. *Anal. Chim. Acta, 58(1):141-147, Jan. 1972. 23 refs.*

A simple, sensitive, and specific method for the determination of ozone in the atmosphere is described. Reactions of ozone with several 1-alkanes were studied at room temperature. Eugenol (4-allyl-2-methoxyphenol), when reacted with ozone, produced relatively large amounts of formaldehyde compared to other 1-alkanes tested. The method described was compared with an alkaline iodide method for the determination of various concentrations of ozone in the range 0.05-2.0 ppm. Hydrogen peroxide, peracetic acid, sulfur dioxide, and various reducing agents commonly present in the air, do not interfere. When present in the air, formaldehyde must bye determined simultaneously and the concentration of formaldehyde subtracted from that of ozone, Any formaldehyde monitoring equipment can be easily adapted for the determination of ozone. (Author summary modified)

18193 APTIC NO. 36859

Sato, Shizuo

STUDY OF THE INFLUENCE OF SO2 ON NO2 MEASUREMENTS. *(NO2 sokutei-chi ni oyobosu SO2 no eikyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):66, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The effect of sulfur dioxide on the determination of nitrogen dioxide was examined. First, sulfur dioxide solutions of several different concentrations were added to the nitrogen dioxide solution, the rate of light absorption of which is 0.315; the light absorption rates were measured. The more concentrated the sulfur dioxide and the more time elapsed after the mixing, the less was the rate of absorption. When nitrogen dioxide gas and sulfur dioxide gas are mixed at the ratio of from 1 to 1 to 1 to 10 (1 to 2 in average, for the air in a measurement) by means of permeation tubes, no effect is seen for ratios of 1 to 1 and 1 to 1.5 after 24 hr and for a ratio of 1 to 10 after 4 hr.

18194 APTIC NO. 36191

Sawicki, Carole R. and Frank P. Scaringelli

COLORIMETRIC DETERMINATION OF NITRATE FOLLOWING HYDRAZINE REDUCTION TO NITRITE. *Air Pollution Control Office, Research Triangle Park, N. C., Div. of Chemistry and Physics, 29p., 1971. 26 refs.*

Since nitrate could be a precarcinogen or a pretoxicant, several sensitive, reproducible manual methods for the determination of nitrate based on the copper-catalyzed reduction of nitrate to nitrite with hydrazine sulfate were developed. Optimum conditions were obtained using sulfanilamide and N-(1-naphthyl)ethylenediamine dihydrochloride as the color-developing reagent. Two new and even more sensitive pairs of reagents for nitrate analysis are introduced that do not involve the use of a possibly carcinogenic naphthylamine. These were 4-aminoacetophenone and azulene or 8-anilino-1-naphthalenesulfonic acid. (Author summary)

18195 APTIC NO. 35040

Scherbak, Michael P. and Thomas A. Smith

A COLORIMETRIC METHOD FOR THE DETERMINATION OF TOTAL OXIDES OF NITROGEN IN CIGARETTE SMOKE. *Analyst (London), 95(1136):964-968, Nov. 1970. 11 refs.*

A method is described for determining the oxides of nitrogen present in tobacco smoke. Components of the vapor phase of smoke are trapped on charcoal. The trap is eluted with sodium hydroxide solution and the oxidation products of nitric oxide appear as nitrite and nitrate salts. An ion-exchange technique is used to release and purify the free acids by removing the excess of alkali. They are then neutralized, made just alkaline, and evaporated to dryness. The residual salts are dissolved in sulfuric acid, iron(II) sulfate is added, and the absorbance of the pink complex is measured. The equivalent concentration of oxides of nitrogen is determined from a calibration graph obtained with nitrate standards. The method overcomes some of the problems of those reported previously, in that it determines both major products of oxidation of nitric oxide in smoke, and avoids the use of nitric oxide gas to prepare standards. (Author abstract modified)

18196 APTIC NO. 36865

Schulze, Ferdinand

METHOD AND APPARATUS FOR ANALYSIS OF GASES FOR SULFUR DIOXIDE. *(Assignee not given.) U. S. Pat. 3,567,392. 5p., March 2, 1971. 6 refs. (Appl. April 23, 1968, 5 claims).*

Colorimetric methods for the analysis of gases in general, and sulfur dioxide specifically, are known. These methods depend on the principle of absorbing the gas to be tested in an aqueous testing medium which contains a reagent capable of spectral change upon contact and/or reaction with the gas to be tested. The present method depends on the fact that sulfur dioxide plus formaldehyde in the presence of acid will react with certain free amino-containing dyes to form the more highly colored N-methyl sulfonic acid derivative of the dye.

18197 APTIC NO. 36052

Schwartz, C. W.

FORD MOTOR COMPANY S MOBILE EMISSIONS TEST LABORATORY. *Preprint, Society of Automotive Engineers, Inc., New York, 7p., 1971. 1 ref. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710170.)*

The Mobile Emissions Test Laboratory contains all facilities such as chassis dynamometer, gas analyzers (for carbon monoxide, carbon dioxide, nitric oxide, and hydrocarbons), test environment, and support services necessary to conduct federal emissions tests anywhere in the country. The trailer housing the facilities is compartmented into three sections for instrumentation, vehicle testing, and support equipment. The center vehicle test section is expanded on site, providing an enclosed 13 by 30-ft area. A convenient feature is the drive-through for test cars. The METL can operate at temperatures as low as minus 10 F and provides accurate, reliable results on field test programs. (Author abstract modified)

18198 APTIC NO. 37175

Sciaraffa, P. L. and C. A. Ziegler

AUTOMOBILE EXHAUST ANALYSIS FOR LEAD USING A NUCLEAR TECHNIQUE. *Isotop. Radiat. Technol., 8(2):163-164, Winter 1971.*

An x-ray fluorescence analyzer for determining airborne lead concentrations is decribed. The instrument consists of an electric console and a probe containing a radioactive source that emits radiation only in the direction of the sample, i.e., particles collected on a Millipore filter. The characteristic X-rays emitted in turn by the sample pass through the window of an X-ray detector that resolves X-ray energies and produces voltage pulses. The pulses are sorted and counted by the electronic console, and the number of pulses is displayed digitally on the console. This number is then used in conjunction with a calibration chart to obtain the amount of lead in the sample. Typically, air-sampling times of 6-12 hr in urban areas provide enough lead sample for measurement. Without filters for canceling out background radiation, the minimum quantity of lead detectable with the instrument is 5 micrograms. With filters, the amount is 15-20 micrograms.

18199 APTIC NO. 36421

Sem, G. J., J. A. Borgos, and J. G. Olin

AUTOMATIC MONITORS OF PARTICULATE MASS EMISSIONS FROM STATIONARY FOSSIL-FUEL COMBUSTION SOURCES. *Preprint, American Inst. of Chemical Engineers, New York, 47p., 1971. 32 refs. (Presented at the American Institute of Chemical Engineers, National Meeting, 68th, Houston, Tex., Feb. 28-March 4, 1971, Paper 68d.)*

Various approaches are considered for the automatic, continuous measurement of the rate of particulate mass emissions from smoke stacks on large coal and oil combustion facilities. Reasons are cited for rejecting a number of particle sensing techniques. Comparative evaluation shows that beta radiation attenuation and piezoelectric microbalance techniques offer the best possibilities for accurate monitoring at the present time. Although the electrostatic and light transmission techniques offer several desirable operational features, their inability to sense the mass of particles severely limits their usefulness for monitoring particulate mass emissions. (Author abstract modified)

18200 APTIC NO. 36061

Shaw, Manny

PLUG-IN SENSORS FOR AIR POLLUTION MONITORING. *Preprint, California Air Resources Board, Sacramento and California State Dept. of Public Health, 8p., 1971. (Presented at the Conference on Methods in Air Pollution and Industrial Hygiene Studies, 12th, Los Angeles, Calif., April 6-8, 1971.)*

A series of plug-in sensors for selective measurement of sulfur dioxide, nitric oxide, nitrogen dioxide, total nitrogen oxides, and hydrogen sulfide are described. Operation is based on the generation of an electric current caused by the electocatalysis of the pollutant species. The sensor itself is a liquid-state device containing an electrochemically sensitive activating surface layer, where strongly adsorbed gas molecules undergo a change of oxidation state as a result of electrocatalytic action, producing a charged surface. Sensor selectivity and sensitivity are determined by the nature of the membrane covering the activating layer and the thermodynamic and kinetic parameters differentiating the electrochemical conversions of the various gas species. Measurement accuracy depends on the accuracy of the chemical analyses of the calibration gas used to standardize the instrument and the frequency of recalibration. The range of capability of the various series extends from the low ppm (lower than 100) to measurements in the ambient and plume ranges. Analyzers containing the sensors are being used for source monitoring in the chemical, petroleum, automotive, and electrical utility industries.

18201 APTIC NO. 36878

Shirasawa, Tadao

DUST CONTROL TECHNIQUE. *(Baijin boshi gijutsu). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 7(12):724-734, Dec. 1971.*

An apparatus for testing the amount of soot formation by coal was constructed. The apparatus consisted of a heater at the bottom, a grate, an oblong combustion chamber lined with refractory bricks, fans below and above the heater, a soot collection pipe filled with glass wool above the combustion chamber, and a gas scrubbing jar connected with a suction pump. Three hundred grams of coal of 5 to 10 mm diameters were placed on the stainless steel grate and was ignited from above, with oiled charcoal as kindling. The coal may be ignited from below by the electric heater. The same amount of the primary air is to be supplied by the fan below. The temperature of the combustion chamber walls is to be kept constant by the electric heater installed inside the wall. The combustion gas goes through the refractory glass wool in the chimney tube and is completely collected by a suction pump. The collected soot is weighed and the amount represents the total soot formation of a given type of coal. An optical smokemeter is installed at the exit of the chimney; the density of smoke is measured by permeability. The time variation of permeability in the beginning and end of combustion can be detected by the meter. A formula for calculation of soot density in flames is reviewed. Basic studies of soot formation by various scientists are briefly reviewed. Finally, various methods of dust collection, principles, costs, capacities are reviewed by discussion, tables, and formulas.

18202 APTIC NO. 37206

Sofuku, M., S. Izumikawa, H. Yamazaki, and T. Odaira

DETERMINATION OF PAN IN ATMOSPHERE. *(Taikichu no PAN no bunseki ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):44, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

In order to confirm the actual existence of photochemical reactions in Tokyo air, peroxyacetyl nitrate which is known to be a substance produced by photochemical reaction, was investigated by gas chromatography; a syringe was used for sampling. The existence of PAN was qualitatively confirmed. Generally, it is detected when nitrogen dioxide concentration is low and the intensity of the sunlight is considerably high. However, final assessment has to be delayed until more data has accumulated.

18203 APTIC NO. 36050

Stivender, Donald L.

DEVELOPMENT OF A FUEL-BASED MASS EMISSION MEASUREMENT PROCEDURE. *Preprint, Society of Automotive Engineers, Inc., New York, 18p., 1971. 21 refs. (Presented at the Society of Automotive Engineers International Mid-Year Meeting, Montreal, Canada, June 7-11, 1971, Paper 710604.)*

A calculational procedure is derived which expresses exhaust emissions on a fuel basis. Existing vehicle exhaust sampling procedures are utilized, together with fuel consumption data which are simultaneously obtained. since no measurements of exhaust or air flow are required, the procedure is not limited by powerplant size. Emission values are computed in terms of grams per mode and grams per mile, as well as on corrected molar concentration (fuel) bases. Additional calcualted vehicle developmental parameters include air-fuel ratio (carbon balance and oxygen balance), air consumption, dry exhaust volume, fuel economy, and combustion efficiency. Conversion of wet exhaust analyses to dry bases is considered. Actual mass emissions are determined for both the current federal seven-mode cycle and the 1972 federal test cycle. The observed, uncorrected vehicle concentration data, together with fuel flow data obtained by means of a digital fuel meter, are reduced by means of an on-line computer installation. In addition to tests of lean, catalytic, and rich reactor vehicles, this procedure has been employed for vehicles powered by gas turbine, steam, diesel, and hybrid internal combustion engine-electric powerplants, including some vehicles in the 1970 Clean Air Car Race. (Author abstract)

18204 APTIC NO. 36890

Suplinkas, Raymond J.

AIR POLLUTION MEASUREMENTS IN THE FRESHMAN LABORATORY. *J. Chem. Educ., 49(1):24-25, Jan. 1972. 4 refs.*

Portable sampling equipment independent of an outside power source was assembled for a student air-quality survey in New Haven. The apparatus consisted of a lightweight, rechargeable nickel-cadmium battery; a transistorized inverter with adequate power capacity to operate a vacuum pump; an absorbing train comprising bubblers and U-tube traps; and a flowmeter with a regulating valve. The pump and power source were mounted in one carrying case; the flowmeter, absorbing train, and a timer in another. Sampling for sulfur dioxide, oxidants, nitric oxide, and nitrogen dioxide took from 30 min to an hour. Analysis of the contents of the bubblers was completed in less than an hour. Measured concentrations of nitric oxide, nitrogen dioxide, and ozone are plotted as a function of time.

18205 APTIC NO. 36836

Suzuki, Akira, Masami Nukada, Masao Nagaoka, and Teruaki Hisaka

DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (II) SOME QUESTIONS FOR DETERMINATION OF HYDROCARBONS BY THE HYDROCARBON ANALYZER. *(Taiki osen sokuteiyo kosei gasu ni kansuru 2.3. no chiken (sono 2), tanka suiso bunsekikei deno tanka suiso sokutei ni kansuru ikutsuka no mondaiten). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):53, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A hydrocarbon analyzer which makes use of flame ionization and features continuous measurement and better sensitivity, response velocity, and linearity is examined. Differences are shown by this analyzer between sample gases of hydrocarbon and nitrogen and hydrocarbon and air; the analyzer gives smaller values for a sample including paraffin hydrocarbons, as the concentration of oxygen in the sample increases and the change in oxygen concentration is more influential when pure hydrogen is used as fuel than hydrogen and nitrogen. While indicated values are approximately proportional to the number of carbons in hydrocarbons for paraffin hydrocarbons, this is not the case for olefin hydrocarbons.

18206 APTIC NO. 36097

Takagi, Shinji, Kazuhiko Endo, and Kazuma Kumai

STUDIES ON THE ERRORS OF SULFUR DIOXIDE DETERMINATION IN THE ATMOSPHERE BY WEST-GAEKE METHOD. *Central Research Inst. of Electric Power Industry, Tokyo (Japan), Analytical Chemistry Section; Central Research Inst. of Electric Power Industry, Tokyo (Japan), Material Chemistry Section, TR-CH-69002, 13p., Feb. 1970. 7 refs.*

The errors of the West-Gaeke method were examined and improvements were made to investigate the real difference between measured values by a conventional West-Gaeke method and an air pollution meter using the conductometric method. The repeatability of the conventional West-Gaeke method was 6.4% (coefficient of variation). To decrease this error, improvements were made on the procedure of sampling and spectrophotometric analysis. Determinations could be carried out within two percent of the coefficient of variation. The accuracy of the West-Gaeke method was examined with a standard gas sample. Measured values were approximately nine percent lower than calculated values on the absorbing solution at 30 C. The absorbing efficiency of sulfur dioxide was 100%, and a tendency was shown that sulfur dioxide was oxidized by aeration in water. The effect of nitrogen dioxide, chlorine, hydrogen chloride, iron, or copper was removable. With the following improvement, sulfur dioxide in the atmosphere was determined in the field within experimental errors of 1.3%. Errors were eliminated with calibration using a standard gas, precise measurement of the gas volume was made with a wet-type gas meter, and the temperature was controlled in the spectrophotometric analysis. (Author summary modified)

18207 APTIC NO. 36300

Tamori, Y.

RECENT TREND ON MEASUREMENT OF SOOT AND DUST, AND TECHNIQUE OF DUST COLLECTION. *(Baijin keisoku oyobi shujin gijutsu no saikin no doko). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 23(12):27-35, Dec. 1972. 13 refs.*

Various measurement methods for soot and dust, and dust collection methods are reviewed. Brief discussion includes the telescopic soot concentration observer, SMD (smoke density), Ringelmann s chart, the dust tube method, the light permeability method, and the Japanese Industrial Standard cylindrical filter method. The principles and operational methods of the dust tube sampler and the cylindrical filter paper sampler, and the principle and the calculation method of a cascade impactor are discussed. As dust collection apparatus, the totem pole scrubber, the overflow type scrubber, the Swedish type scrubber are discussed. The bag filter, the high temperature gas treatment by the jet spray cooling method, the heat exchange method, and the cold air mixture method are described. For brushing the dust off the filter, the mechanical method by springs, the reverse jet method, the air jet method, and the ultrasonic method are mentioned. The properties of various filters of such materials as polyester, acrylic, tetrafluoride ethylene, and glass fiber are reviewed by a table.

18208 APTIC NO. 36822

Tamori, Yukio, Nobuyuki Kogure, and Kazunari Imagami

CUPOLA STACK GAS CONCENTRATION MEASUREMENT AND DUST COLLECTION. *(Kyupora haigasu no baijin nodo sokutei to shujin taisaku ni tsuite). Text in Japanese. Kogai (Hakua Shobo) (Public Nuisance), 6(16):398-405, Nov. 1971. 9 refs.*

The previously introduced, new quartz-glass cylindrical filter paper sampler was applied for the first time for sampling of high temperature cupola stack gas and was found satisfactory. Problems in the sampling of the high temperature gas of cupolas are the durability of the sampler material and the packing portion of the sampler. Stainless steel and quartz glass can endure temperatures up to 1000 C, but certain types of stainless steel are unsatisfactory. The cylindrical quartz glass filter paper sampler, which was introduced in a previous issue, is less expensive, simpler to operate, and faster, than the dust tubes designed by the Japanese Industrial Standards. The results of measuring dust concentrations by the new sampler are presented. Instead of using an umbrella at the top of the cupola as in the previously practiced method, a hood was designed and installed at the top of the furnace and the gas current was adjusted. Three samplers were inserted in the measuring holes. The temperature and the flow speed of the stack gas were measured continuously. The dust concentration was 2.28 g/N cu m in the beginning of the operation of the furnace, but increased to 3-4 g/N cu m, and stabilized. The water scrubbing dust collection device at the top of the cupola was ineffective. The dry and wet dust collection methods are reviewed. The slit method, centrifugal method, shower methods, a cyclone, a venturi scrubber, and a bag filter are discussed with illustrations.

18209 APTIC NO. 36179

Thomas, W. A., L. R. Babcock, Jr., and W. D. Shults

OAK RIDGE AIR QUALITY INDEX. *Oak Ridge National Lab., Tenn., Environmental Indices Group; Illinois Univ., Chicago, Dept. of Energy and Systems Engineering; and Oak Ridge National Lab., Tenn., Analytical Chemistry Div., Atomic Energy Commission Contract W.7405-eng-26, 10p., Sept. 1971.*

NTIS: ORNL-NSF-EP-8

The Oak Ridge Air Quality Index (ORAQI) provides an objective assessment of air quality and is easily calculated with the aid of a nomograph. Pollutants included in the ORAQI are carbon monoxide, nitrogen dioxide, sulfur oxides, particulate matter, and oxidants (including hydrocarbons). The index can be calculated, however, even if a city does not monitor all five pollutants. The nomograph has five summing columns, each with an appropriate scale of pollutant values and a scale on index units on which the Federal standard is equal to 10 divisions. For each column, the number of index units corresponding to the appropriate pollutant value is counted. Three other scales on the nomograph allow conversion of the measured total to the air quality index, the range of which is set so that the value of unpolluted air is 10, and the index equivalent to all pollutants at their legal maximum is 100.

18210 APTIC NO. 36838

Tsuji, Kusuo

STUDIES OF SUSPENDED PARTICULATES IN AIR (4). *(Taikichu no fuyu funjin ni kansuru kenkyu (daiyonpo)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):81, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

A method to determine selenium in the air, which might have increased due to mass production of semi-conductors as well as dyes and alloys, was tested. Generally, selenium is determined by means of colorimetry. In this study, after treating the sample with aqua regia or a mixture of hydrochloric acid and potassium chlorate, chlorine is eliminated. Then, selenic acid is converted to selenious acid by heating with hydrochloric acid and polarography is used to determine the selenium.

18211 APTIC NO. 36202

Wajsfelner, R.

ON THE DETERMINATION OF AEROSOL PARTICLE SIZE DISTRIBUTION BY THE DIFFUSION BATTERY METHOD. *(Etude de la granulometrie d un aerosol par les batteries de diffusion). Text in French. Preprint, Faculte des Sciences de Paris (France), p. 1-29, 1968. 19 refs. (Presented at the Seminaire de Physique des Aerosols, Paris, France, 1968.)*

The reduction of concentration of aerosol particles by diffusion in the vicinity of a wall of a pipe or tube through which the aerosol passes can be used to estimate particle size. Such measurements are carried out by diffusion batteries of circular and rectangular channels. Fundamental equations valid for monodisperse aerosols worked out by Townsend, Gormley and Kennedy, De Marcus and Thomas, and more recently by Twomey are based on the assumptions that only diffusion is operative, that the flow in the battery is laminar, that the particles can be characterized by a single diffusion coefficient, that the concentration of particles is constant at the battery entrance, and that particles coming in contact with the wall are trapped by it. For heterogeneous aerosols the equations derived for monodisperse aerosols must be modified in serveral respects. The reduction in concentration by diffusion of a mixed aerosol is the sum of reductions of its components. The Pollack and Metniecks calculation procedure is outlined and demonstrated.

18212 APTIC NO. 37161

Willis, Donald E.

GAS CHROMATOGRAPHIC ANALYSIS OF OFF-GAS HYDROCARBON PYROLYSIS. *Anal. Chem., 44(2):387-390, Feb. 1972. 6 refs.*

An aluminum gas chromatograph column for analysis of light hydrocarbons was combined with pre-column to provide a rapid, accurate method for a more complete characterization of pyrolysis off-gas. The pre-column (seven-ring polyphenyl ether) provides resolution of benzene and toluene and retains these components until an appropriate time in the elution of components from the alumina column. The latter resolves all C1-C3 components and gives adequate resolution of C4-C6 components of commercial interest. The flow pattern through the columns is controlled by a rotary switching valve. With the valve in mode I, carrier gas flows through both columns and then to a flame ionization detector. Switching the valve to mode II sends the effluent from the pre-column directly to the detector and puts the alumina column into a closed loop (no carrier gas flow). Chromatograms are presented of a typical off-gas from high-severity thermal cracking of a field condensate and of a light oil sample.

18213 APTIC NO. 36915

Willis, Harry Arthur and Edward Arthur Cudby

GAS SAMPLE ANALYSIS CELLS. *(Perkin-Elmer Ltd., Beaconsfield (England)) U. S. Pat. 3,567,329. 9p., March 2, 1971. 8 refs. (Appl. Sept. 30, 1968, 9 claims).*

New and improved analytical gas cells incorporating a light guide, as used in infrared spectrophotometry for gaseous samples, are presented. Known cells are normally mounted so that the radiation source may be brought to a focus at any entrance aperture situated at one end of the cell while the monochromater slit image may be located at an exit aperture situated at the other end. Since a considerable length of cell is required to produce a significant increase in radiation per unit volume through the cell, it follows that the cells can only be incorporated in specially designed instruments and cannot be easily adapted for use with designs intended for ordinary non-reflective cells. In the new apparatus, entrance and exit apertures are located at one end of the cell, with a concave mirror at the other end of the tubular cell. The entrance and exit apertures are at conjugate image planes relative to the converging mirror, so that radiation entering the entrance aperture is efficiently transferred through the other window. The long reflecting side walls of the cell act as a light pipe to increase the effective radiation flux density in the gas sample within the cell, without disturbing the conjugate optical relationship between the apertures relative to the converging mirror. (Author abstract modified)

*18214* *APTIC NO. 36515*

*Yamashita, K.*

*ACCESSIBLE DUST PARTICLES FOR TESTS. (Nyushu shiyasui shikenyo funtai ni tsuite). Text in Japanese. Kuki Sekjo Clean Air J. - Japan Air Cleaning Assoc., Tokyo), 9(5):55-60, Dec. 1971. 8 refs.*

Dust particles available on the market for calibration or performance tests of dust collectors or measurement equipment are discussed. The types, content, specific weights, shapes, humidity, methods of obtaining, and the kinds of tests are discussed and reviewed by tables and graphs. Various kinds of talc, fly ash, cement, and carbon black are discussed. It is hoped that the Japanese Industrial Standards will be designated for test materials including mixed powders, glass balls, microdusts, and mists, and content, specific weights, shapes, humidity, obtaining methods are reviewed by a table.

18215 APTIC NO. 37178

Yamashita, Kenichi and Nobushige Koiso

CONTAMINATION CONTROL. *(Kontamineshon kontororu). Text in Japanese. Ministry of International Trade and Industry, Tokyo (Japan), Government Mechanical Research Lab., 1p., 1971. (Presented at the Meeting of the Government Mechanical Research Laboratory, Tokyo, Japan, Dec. 16, 1971.)*

For the manufacturing installation of precision machines and meters, a clean room, which is free of suspended particulates in addition to control of temperature and humidity, is necessary. The levels of cleanliness and the use of a clean bench by such factories are designated by the United States Federal Standards, and the measuring methods of suspended particulates are established by ASTM and SAE. Measurements of suspended particulates were taken in a sub-clean room, using the methods designated by ASTM and SAE, and the level of cleanliness was compared with the clean room standard. The standard microparticulate automatic measurement apparatus and various membrane filters were used for measuring suspended particulates and results were compared. The time variation of suspended particulates were examined with regards to the use of an air conditioner and clean bench.

18216 APTIC NO. 36837

Yoshiyama, H. and T. Tajiri

STUDY ON EVALUATION CHOICE SAMPLING OF AIRBORNE DUST. *(Fuyu funjin no sebtaku saijin hyoka ni kansuru kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):82, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Since conventional dust collecting methods can not provide accurate figures for particles with diameters less than 10 micron which is required for the standard of airborne dust concentrations, the capability of a horizontal elutriator (horizontal duct sedimenter) was examined. Limestone dust is fed from an automatic continuous dust feeder into a dust chamber with a volume of 30 cu m, in which the elutriator is placed. The state of selective dust collection is examined by microscopic photography. As a result, this elutriator is effective in selectively collecting particles less than 10 micron.

18217 APTIC NO. 36167

Zutshi, P. K. and T. N. Mahadevan

SPECTROPHOTOMETRIC METHOD FOR THE STANDARDIZATION OF SULPHIDE RADICALS IN SOLUTION. *Indian J. Chem., 9(7):719-720, 1971. 6 refs.*

Crystalline methylene blue is both convenient and reliable for the spectrophotometric estimation of sulfide radical in solution. However, the methylene blue samples should be dehydrated before making the solutions by keeping them overnight in an oven at 80 C.

## AIR QUALITY MEASUREMENTS

18218 APTIC NO. 36206

SUPPLEMENT TO MONTHLY REPORT. DETAILS OF MEASUREMENT RESULTS. AUGUST 1970. *(Annexe au rapport mensuel. Detail des resultats de mesure. Aout 1970). Text in French. Inst. National de la Sante et de la Recherche Medicale, Vesinet (France), Service Central de Protection contre les Rayonnements Ionisants Rept. SCPRI (RM)-VIII-1970, 21p., Aug. 1970.*

Detailed results of monitoring radioactivity of the atmosphere at ground level, at an altitude of 12000m, of rain water, of surface and subterranean water, of irrigation water, of drinking water, of milk, vegetables, cattle, fish, sea water, of hydromineral sources, and of soil (trimonthly reports only) for the month of August 1970 are published. Atmospheric radioactivity was: beryllium (7) 0.050, strontium (90) 0.0048, zirconium (95) and niobium (95) 0.074, rubidium (103) 0.010, Ru-106 and ruthenium (106) 0.045 iodine (131) 0.0020 cesium (137) 0.0080, and barium (1HO) and lanthanum (140) 0.0033 pCi/cu m air. Total mean beta activity at nucler site at Fontenay-aux-Roses was 0.23 pCi/cu m air. High-altitide contamination of an aircraft surface was 1.1 mCi/sq m filter. Rain water maximim at nuclear site at Fontenay-aux-Roses was 150 pCi/l. Irrigation water from the Seine at Vesinet had a total beta radiation of 4.8 pCi/1. Filtered drinking water from Rhone had a mean activity of 4.4 pCi/1. Milk has Sr(90) maximum 32 pCi/1. Vegetables Sr(90) mean value was 10 pCi/g ashes. Cattle thyroid I(131) was below a measurable threshold. Salt-water fish Cs-(137) was 26 pCi/kg fresh. Sea water at La Manche had Cs-(137) 1.2pCi/1. Of 20,844 workers potentially exposed to radiation in 2962 establishments (medical and nuclear), 60 exhibited excessive radiation levels of the third category.

18219 APTIC NO. 36264

VOLUNTEERS FOR AIR MONITORING PROJECT (VAMP). *Cooperative Science Education Center, Inc., Rept. 1, 13p., Sept. 1971.*

The Volunteers for Air Monitoring Project has resulted in the largest citizen-scientist air monitoring effort in the history of the United States. Nearly 21,000 public secondary school students and their teachers across the state of Tennessee received monitors during late March, 1971. On April 1, these sedimentation foils, coated with adhesive, were placed in open areas where they collected insoluble particulates (dust fall) for a 30 day period. The weight gains for individual counties, in terms of tons per square mile, ranged from 3.8 to 13.4, with an average county gain of 6.6. (Author summary) 0

18220 APTIC NO. 36813

Ministry of Health and Welfare (Japan), Public Nuisance Section

MATERIAL FOR THE AMENDMENT OF STANDARD OF SOOT AND DUST. *(Funjin haishutsu kijun kaitei shiryo). Text in Japanese. 60p., Oct. 1970.*

The present report deals with the principles of the amendments of the standard for soot and dust emissions associated with concrete works. The results of the measurement of soot and dust-emitting industries in Osaka, Kanagawa, Hyogo, the other 10 Prefectures, and 6 cities are given. The concentrations of floating dust in Osaka and Tokyo was determined. The concentration of the metal elements in floating dust in developing districts and Osaka was also measured. The chemical elements of the ashes from coal and heavy oil, the size distribution of soot and dust, and the concentration of soot and dust discharged from a steam-power plant were determined. Air pollution data from the U. S. is given. The diffusion formula for soot and dust is discussed.

**18221** APTIC NO. 36815

Tokyo Metropolitan Government (Japan), Shinagawa Ward Office

INVESTIGATION OF AIR POLLUTION WITHIN SHINAGAWA WARD. *(Shinagawa-kunai ni okeru taikiosen chosa hokoku). Text in Japanese. 55p., June 1971.*

Sulfur dioxide was measured at four places in Shinagawa ward: the Daini Hino elementary school, the Shimiaudai elementary school, the Suzugamori elementary school, and the Shinagawa ward office during Feb. 8 to March 10, 1971. The SO2 concentration was measured by hour and day and with different wind direction and velocity. The transmittance and reflectance of particulates in the air was measured by tape air sampler by day and hour. Meteorological data observed by the Tokyo Meteorological Observatory during the period of this investigation and maximum, minimum, and mean values of SO2 were measured at 10 different points in Tokyo. Air pollution of Shinagawa ward resulted from the primary pollutants of Tokyo-Chiba-Yokohama industrial districts. The north-northeast or northeast wind was often observed in Shinagawa ward; the mean concentration of SO2 in four places was 0.005 ppm and 70% of the whole was under the mean value. The standard value of an Emergency in Tokyo (0.2 ppm) was only 1% of the whole, however, it tended to increase and was observed at all places, which should be taken into further consideration. Pollution at the Suzugamori elementary school was significent, and the concentration below 0.05 ppm was counted at 40%, over 0.2 ppm was 3.4%, and the maximum value of concentration was 0.42 ppm. Average value of the transmittance of particulates in the air was 11, which showed a lower value compared with 13, the value in a previous investigation (Aug. 1969). Thus, pollution by particulates became lower each year. More items should be added for future observation, and particulate substance should be indicated by weight concentration which is used for the environmental standard.

**18222** APTIC NO. 36831

Sapporo City (Japan), Public Health and Hygiene Section

PRESENT STATE OF COUNTERMEASURES AGAINST POLLUTION IN SAPPORO CITY. *(Sapporo-shi ni okeru kogai taisaku no genkyo). Text in Japanese. 26p., Aug. 1970.*

Activities for the countermeasure against environmental hazards such as air pollution, and pollution by noise, water, and offensive odor were reported for Sapporo City in 1970. Air pollution in Sapporo City was mainly due to heating systems during the five winter months. Because of the recent use of kerosene in place of coal as a fuel, the amount of soot showed no marked fluctuations and tended to decrease. On the other hand, the amount of sulfur oxides tended to increase, especially in the center of the city which has large scale heating systems. The monthly average value of SO2 for five months was 0.076 ppm, which was higher than the value of environmental standard. Exhaust gas from automobiles offered no problem at present. The effect of offensive odor from barns and chemical factories was a big problem to the residential area. Carbon monoxide, nitric oxide, and nitrogen dioxide were also measured.

**18223** APTIC NO. 36872

Japan Pharmaceutical Assoc.

REPORT OF INVESTIGATION ON ENVIRONMENTAL HAZARD CAUSED BY TRAFFIC IN MAIN CITIES OF JAPAN. *(Zenkoku shuyo toshi kotsu kogai chosa hokoku). Text in Japanese. 13p., June 1970.*

Carbon monoxide, dust, noise, meteorological conditions, and traffic volume were determined in 254 cities, towns, and villages throughout Japan. A clear day was chosen from a so called drugs and health week of Oct. 12-18, and ten minutes from 8:00, 10:00, 12:00, 14:00 and 17:00 were assigned for the estimation. Results were collected by cities, towns, and villages (below 5 million, 5-20 million, 20-25 million, and over 50 million). The average concentration of carbon monoxide per day was 5 ppm at cities below 5 million in population, 7 ppm at cities of 5-20 million, 8 ppm at cities 20-50 of million, and 10 ppm at cities over 50 million. The mean absorbance of dust/day was 0.09 at cities below 5 million, 0.12 at cities of 5-20 million, 0.13 at cities of 20-50 million, and 0.11 at cities over 50 million. Average traffic values/day were 133.5 cars/10 min at cities below 5 million, 217-4 at cities of 5-20 million, 363.3 at 20-50 million cities, and 475.6 at cities over 50 million.

**18224** APTIC NO. 36875

Tokyo Metropolitan Government (Japan), Public Nuisance Section

REPORT ON THE SURVEY OF AIR POLLUTION IN OTA-WARD. GENERAL REPORT. *(Ota-ku taiki osen chosa hokokusho. sokatsu). Text in Japanese. 320p., March 1971. 52 refs.*

Measurement methods, the present condition of air pollution in Tokyo, and the monitoring system are discussed. The air pollution of Ota Ward is examined from the viewpoint of wide area pollution, limited area pollution, and automobile exhaust gas pollution. Sulfur dioxide and floating particulates were measured at six observation points in the Ward and compared with the constant estimation at six points within the Tokyo area. For the theoretical examination of wide area pollution, a diffusion formula was adopted. The future of wide area pollution of Ota Ward was predicted based on these results. Limited area pollution due to exhaust gas from factories, the results of a five month estimation of SO2 and floating particulates at one measuring point in the industrial area, was examined. The index of pollution concentration was obtained from the number of complaints. Air pollution from automobiles at main intersections in Ota Ward was examined. A theoretical analysis was made on limited area pollution due to automobile exhaust gas. The situation of air pollution in Ota Ward is quite unfavorable from the viewpoint of wide area pollution, limited area pollution, and automobile exhaust gas pollution. It is necessary to take strong measures to meet the situation in the future. Countermeasures and control of pollution are also discussed.

**18225** APTIC NO. 36876

Tokyo Metropolitan Government (Japan), Dept. of Construction and Public Nuisance

REPORT ON SURVEY ON AIR POLLUTION (OF LIMITED AREA) IN OTA WARD 1970. *(Ota-ku taikiosen (kyokuchi) chosa hokokusho). Text in Japanese. 91p., March 1971.*

Estimations of sulfur dioxide and carbon monoxide concentrations in the air in Ota Ward, Tokyo, during the period of April 1970 and March 1971 were reported. Forty-two estimation points were set up at every 1 sq km in the ward, and estimation was made six times a day and once a month. The SO2 was estimated by SO2 gas detection paper, and CO was estimated by a detection tube. The results of the estimations of wind direction and velocity, temperature, and SO2 and CO concentrations were compiled into a chart every month for each estimation point. And the conditions at each estimation point were drawn. The SO2 concentration showed slight fluctuations in spring and in summer, but more SO2 was detected in the summer when a south wind blew. In the fall, higher concentrations were detected, while in winter lower concentrations were detected, due to strong wind on the estimation days. The CO concentration was comparatively high in the spring and fall, and was lower in the summer than in the winter. High concentration in winter showed two peaks, it tended to rise between 8 and 10 o clock in the spring and fall and dropped in the summer and winter.

18226 APTIC NO. 36881

Ministry of Health and Welfare (Japan) and Aichi Prefectural Government (Japan)

PRELIMINARY REPORT ON THE INVESTIGATION ON AMBIENT AIR IN THE SOUTHERN PART OF NAGOYA (DATA SECTION). *(Nagoya nanbu chiku jisen chosa hokokusho (Shiryohen)). Text in Japanese. 141p., March 1970.*

The actual state of conditions and the yearly changes of the air and weather in the southern part of Nagoya was studied. The environmental investigation was carried out from Sept. 24 through Oct. 1, 1969 and the meteorological investigation from Sept. 25 to Sept. 30. Concentrations of sulfur oxides and floating dust were measured, and the vertical distribution of the temperature, the wind direction, the wind speed, changes of air current, and the weather were observed. The methods of collecting samples, analytical methods, measuring machines, and measurement locations were reported. The following are given: the state of establishments of industries, fuels mainly emitting soot and smoke, concentrations of floating dust by day, measuring locations, hourly and weekly average concentrations by measuring spot and by hour, the composition of floating dust, general weather conditions, the wind rose, the wind direction, and wind speed by measuring spot.

18227 APTIC NO. 37196

Japan Environmental Agency, Tokyo, Bureau of Atmospheric Safety

A COMPENDIUM OF A NATIONWIDE INVESTIGATION ON AIR POLLUTION CONDITIONS, 1970. *(Zenkoku taiki osen jokyo chosa matome, Showa 45 nendo). Text in Japanese. 127p., 1971.*

Data concerning measurements of sulfur oxides, suspended particulates, nitrogen oxides, carbon monoxide, oxidants, and hydrocarbons are compiled from the air pollution monitoring stations and various local self-governing bodies throughout Japan. Results are presented mostly in table forms. Regular SOx monitoring stations with automatic measuring equipment as of Dec. 1971 were 431, compared with 390 stations in 1970, 251 stations in 1969, and 140 stations in 1967. A generalized picture shows that urban and industrial environment sulfur oxides concentration slightly increased or sustained the same level for 1967 and 1968, and decreased gradually after that. The tendency cannot be proven by simple statistics; but simplified annual average statistics shows that 1967 count was 0.0370 ppm at 83 stations, 0.0244 ppm at 123 stations in 1968, 0.0378 ppm at 198 stations in 1969, and 0.0336 ppm at 305 stations in 1970. Sixteen cities which had not passed the environmental standards up to 1969 passed it in 1970. With regard to individual monitoring stations, of the 190 stations which had not passed the environmental standards in 1969, 18 stations passed in 1970. However, 11 stations which had passed the standards in 1969, failed to do so in 1970. In examining 1970 SOx average general trends, increases of concentration were detected at 49 stations, decreases were noted at 92 stations, and the same averages were sustained at 48 stations. Data concerning suspended particulates were collected at 150 stations in 66 cities. Digital equipment was used and photometric methods were employed for obtaining indexes. Particulates smaller than 10 micron were excluded. Among the 66 cities, eight (20%) maintained the daily average of less than 0.1 mg. The 1970 records showed that 10 monitoring stations had less than 0.03 mg/cu m averages; eight stations had 0.031 to 0.05 mg/cu m; 41 stations had 0.31 to 0.10 mg/cu m averages; 34 stations had 0.101 to 0.15 mg/cu m averages; and 12 stations had more than 0.151 mg/cu m averages. The maximum concentration of 7.47 mg/cu m was detected in Ube city, 6.66 mg/cu m in Tokyo, 5.86 mg/cu m in Tokuyama, 5.80 mg/cu m in Izumi Otsu, and 5 mg/cu m in Annaka.

18228 APTIC NO. 36805

Asakuno, K., K. Nakano, H. Yamasaki, and T. Odaira

RESEARCH ON REGIONAL REPRESENTABILITY OF SO2 CONCENTRATION. *(SO2 no chiiki daihyosei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):205, 1971. 2 refs. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The regional representability of sulfur dioxide concentration was evaluated on two bases, the similarity of the time variation pattern and the similarity of the frequency distribution curve by concentration. At nine to ten locations around each of the five permanent monitoring stations in Tokyo, the SO2 concentration was measured by the conductometric method for 30 days. The time variation pattern was compared by plotting the hourly geometrical mean values. The frequency distribution was compared in terms of the cumulative frequency by classifying the measured concentration values into 22 classes.

18229 APTIC NO. 36236

Berg, Neil and William P. Lowry

TRENDS IN VISIBILITY AT SALEM, OREGON, 1958-1967. *Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 10p., 1968. 5 refs. (Presented at the Air Pollution Control Association, Pacific Northwest International Section, Annual Meeting, Vancouver, British Columbia, Nov. 21, 1968.)*

Hourly data on visibility from the U. S. Weather Bureau Airport Station in Salem, Oregon, were analyzed for the decade 1958-67. Observations analyzed were those from daylight hours without rain, fog, or a relative humidity above 90%; thus, the hours examined are likely to include very few in which visibility was affected by any factors other than smoke and haze. A deterioration in visual range is observed in every month at Salem during this decade. (Author abstract modified)

18230 APTIC NO. 36234

Bouquiaux, J. and J. Grandjean

AIR POLLUTION BY SMOKE AND SO2. *(Pollution atmospherique. Fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol. Belgique, 28p., May 1970.*

The monthly bulletin of atmospheric pollution indexes for May 1970 compiled by the Belgian air pollution recording network contains tables of sulfur dioxide and particulate levels in micrograms/cu/m air recorded by 230 measurement stations. One hundred of these stations are located in the five industrial centers of Brussels (25), Antwerp (25), Liege (20), Charleroi (15), and Gand(15), 100 are located in smaller cities in selected regions of Belgium, and 30 are meteorological stations equipped with anemometers. Data are processed by the Computing Center of the Royal Meteorological Institute. The sampling apparatus developed by the Institute of Hygiene and Epidemiology and the Royal Meteorological Institute consists of an electric membrane pump aspirating approximately 2 cu m air per day through a Whatman No. 1 paper filter, a wash bottle containing 50 ml 0.3% H2O2 solution, and a gas meter. The device contains 8 filter-wash bottle sets, each of which automatically replaces the preceding set at 9:00 each morning; these sets are collected once a week. The filters are analyzed reflectometrically for average daily dust fall levels; the wash bottle contents are titrated acidimetrically for average daily SO2 levels. The city of Brussels in May had a mean daily dust fall of 31 micrograms and a mean daily SO2 level of 102 micrograms (maximum 489, minimum 0).

18231 APTIC NO. 36444

Bouquiaux, J. and J. Grandjean

AIR POLLUTION BY SMOKE AND SO2. *(Pollution atmospherique. Fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol. Belgique 28p., July 1970.*

The monthly bulletin of atmospheric pollution indices for July 1970 compiled by the Belgian air pollution recording network contains tables of sulfur dioxide and particulate levels in micrograms per cu m air recorded by 230 measurement stations. One hundred of these stations are located in the five industrial centers of Brussels (25), Antwerp (25), Liege (20), Charleroi (15), and Gand (15), 100 are located in smaller cities in selected regions of Belgium, and 30 are meteorological stations equipped with anemometers. Data are processed by the Computing Center of the Royal Meteorological Institute. The sampling apparatus developed by the Institute of Hygiene and Epidemiology and the Royal Meteorological Institute consists of an electric membrane pump aspirating approximately 2 cu m air per day through a Whatman No. 1 paper filter, a wash bottle containing 50 ml 0.3% H202 solution, and a gas meter. The device contains 8 filter-wash bottle sets, each of which automatically replaces the preceding set at 9:00 each morning; these sets are collected once a week and analyzed. The filters are analyzed reflectometrically for average daily dust fall levels; the wash bottle contents are titrated acidimetrically for average daily SO2 levels. The city of Brussels in July had a mean daily dust fall of 18 micrograms and a mean daily SO2 level of 52 micrograms (maximum 515, minimum 0).

18232 APTIC NO. 36380

Buck, M. and H. Stratmann

RESULTS OF SULPHUR DIOXIDE MEASUREMENTS WITHIN THE AIR MONITORING PROGRAMME OF NORTH RHINE WESTPHALIA. *(Ergebnisse aus dem Schwefeldioxide-Messprogramm im Rahmen der Luftuberwachung des Landes Nordrhein-Westfalen). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 47-51. 11 refs. (Oct. 4-7, Paper III/4.)*

Sulfur dioxide emissions were measured in North Rhine Westphalia to determine air quality. Measurement methods and subsequent data analysis are described. Based on mathematical analyses, many parts of the Ruhr area exceeded the maximum allowable concentration levels of SO2.

18233 APTIC NO. 36385

Chovin, P. and R. Thiebault

ATMOSPHERIC POLLUTION IN PARIS BY VEHICLE EXHAUST GASES - MEASUREMENT OF POLLUTION LEVELS AND FIRST SUGGESTED REMEDIES. *(Pollution de l atmosphere de Paris par les gaz d echappement des vehicules automobiles - mesure des niveaux et premiers remedes envisages). Text in French. International Union of Air Pollution Prevention Associations, Intern. Clean Air. Congr. Proc., London, England, 1966, p. 179-182. 3 refs. (Oct. 4-7, Paper VI/8.)*

Studies of atmospheric pollution by motor vehicle exhaust gases in Paris determined that pollution was greatest at street intersections when the cars were stopped by traffic lights. The average amount of unburned particles, especially carbon monoxide, in exhaust gases of idling engines was quite high. The effect of an automotive exhaust control method on the concentration of carbon monoxide in a garage was examined.

18234 APTIC NO. 36399

Cooper, R. L. and A. J. Lindsey

ATMOSPHERIC POLLUTION BY POLYCYCLIC HYDROCARBONS. *Chem. Ind. (London), 1953:1177-1178, Oct. 31, 1953. 8 refs.*

The presence of anthracene, pyrene, 1,2-benzopyrene, 3,4-benzopyrene, perylene, 1,12-benzperylene, fluoranthene, anthranthrene, and possibly alkyl pyrene was found in solids filtered from town air in Salford, England. An analysis of a kilogram sample of fresh snow at Ashridge, England revealed the presence of 1-2 micrograms of pyrene and traces of 3,4-benzopyrene and anthranthrene. By precipitation of atmospheric pollution, the presence of polycylic hydrocarbons is explained in such varied materials as sewage humus, surface drainage water, soil, and nasal secretion.

18235 APTIC NO. 37165

Endo, R., K. Kamata, H. Shirakawa, T. Nakashima, T. Kogo, and T. Oya

ON THE ENVIRONMENTAL CONDITIONS OF THE SURVEY POINT HEAVILY CONTAMINATED BY THE AUTOMOTIVE EXHAUST GAS. *(Hokkaido no toshi ni okeru jidosha haishutsu gasu no taiki osen ni tsuite. (daiyonpo). Jidosha haishutsu gasu ni yoru konodo osen chiten no kankyo jokyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):229, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The carbon monoxide concentration at the busiest intersection in Otaru City was surveyed from various aspects: topographical and meteorological aspects, traffic pattern, and effects on human health. The data obtained from July 1969 to October 1970 were tabulated in terms of the maximum hourly average, hourly average taken over periods of daylight and 24 hours. The hourly average concentration was in the range of 39.2 to 9.9 ppm. Results are shown by diagrams and tables.

18236 APTIC NO. 36441

Friedrichs, K. H. and A. Brockhaus

MEASUREMENTS OF CONCENTRATIONS OF PARTICULATE POLLUTANTS IN THE RUHR: TECHNICAL EXPERIENCES AND COMPARISONS WITH RESULTS FROM OTHER COUNTRIES. *(Konzentrationsbestimmungen teilchenfoermiger Luftverunreinigungen im Ruhrgebiet: messtechnische Erfahrungen und Vergleich mit Messwerten anderer Laender). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 248-251. 14 refs. (Oct. 4-7, Paper VII/13.)*

The concentration of particulate matter in environmental pollution was determined by fractional filter sampling and gravimetric analysis in three towns of the Ruhr area. The concentrations of coarse and fine dusts decreased with increasing wind speed, but coarse dust concentrations began to increase when high wind speeds were attained. Low values in the summer and high values in the winter were determined for fine dust, with the reverse determination for coarse dusts. Levels of concentration varied with the industrial character of the towns. The concentration of fine dusts was maximum at the beginning of the week, while coarse dust concentration reached a maximum in the middle of the week. Concentrations decreased at the end of the week. Diurnal patterns were determined by photometric methods.

18237 APTIC NO. 36842

Fujii, Ioru, Ken Matsuo, and Shinji Hirao

ATMOSPHERIC CONCENTRATION OF SULFUR OXIDES IN OSAKA PREFECTURE. *(Osaka fuka ni okeru io sankabutsu nodo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):201, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The concentration of sulfur oxides measured by the lead dioxide method at 211 locations in Osaka from 1967 to 1970 were analyzed. The pattern of frequency distribution by concentration was either logarithmically normal or normal. The high pollutant concentration of 3.0 mg sulfur trioxide/100 cu cm/day was found in relatively wide spread areas in the industrial northwestern section of Osaka. The total amount of sulfur dioxide emissions estimated based on the total fuel consumption showed a yearly increase. The frequency of wind direction corresponded to the higher pollutant concentrations in the northwestern section.

18238 APTIC NO. 36388

Georgii, Hans-Walter

THE CONCENTRATION OF CARBON MONOXIDE MEASURED AT DIFFERENT ALTITUDES SIMULTANEOUSLY IN CITY STREETS. *(Die Vertikalverteilung des Kohlenmonoxid in Grossstadtstrassen in Abhaengigkeit von den meteorologischen Bedingungen). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 209-210. (Oct. 4-7, Paper VI/18).*

Carbon monoxide concentration was measured in city streets at different altitudes above street level and the results were correlated with data on traffic density, wind velocity, and wind direction. A diurnal trend of CO concentration was determined at all levels; the amplitude depended on the emission rate of engine exhausts and wind distribution. Measurements on the lee side of the street and the weather side of the street differed greatly due to winds.

18239 APTIC NO. 36384

Gillham, E. W. F., A. Martin, and F. R. Barber

SULPHUR DIOXIDE CONCENTRATIONS MEASURED AROUND A MODERN POWER STATION. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 185-187. 4 refs. (Oct. 4-7, Paper VI/10.)*

Sulfur dioxide concentrations in the atmosphere of a power station were measured over a two year span and correlated with background pollution and varying meteorological data. The average concentration determined since October 1963 was four pphm. Sulfur dioxide emitted by the power station was determined as 0.2 pphm average, with a maximum of 0.6 pphm. Most of the pollution arrived with northwest and southwest winds; background pollution was often less downwind. Both background pollution and pollution from the station varied with season and weather. Background pollution was highest in the winter, during fogs and inversions, with the highest hourly concentration at 80 pphm. Pollution from the station was lowest during the winter, even during inversions and fog, suggesting dispersion of the hot polumes above the inversion layers. Background pollution was at a minimum and station emissions were at a maximum in strong winds.

18240 APTIC NO. 36229

Grose, Elizabeth S., Maria Szekessy, and Nelly Munoz

AIRBORNE FUNGUS SPORES IN BOGOTA, COLOMBIA: A FIVE YEAR STUDY. *Sabouraudia (Edinburgh), vol. 6:42-49, 1967. 26 refs.*

The results of a survey of airborne fungus spores in Bogota, Colombia during 1959-63 are given. Saubouraud s dextrose agar plates were exposed daily for 15 min at approximately 11 A. M.; plates were then incubated at 25 C for ten days and colony counts were made on the third, fifth, and tenth day. Identification of the fungi was made in situ whenever possible. Daily rainfall and wind velocity data were obtained. A total of 13,051 colonies, 12,788 of which were molds, and 948 yeasts, representing 29 genera, were isolated. The most prevalent fungi were Hormodendrum, Penicillium, Fusarium, Rhodotorula, Aspergillus, Phoma, Alternaria, and Streptomyces. There was no significant correlation between the number and genera of the fungi with the month of the year or with environmental factors such as rainfall and/or wind velocity.

18241 APTIC NO. 36054

Hanan, Joe J.

SECOND AIR ANALYSES IN THE DENVER REGION. *Colo. Flower Grow. Assoc. Bull., no 252:3-4, May 1971.*

In February 1971, sample bottles were distributed to flower growers in the Denver region, and the growers were requested to take outdoor air samples at 0800 hours twice weekly. Results of analyses for ethylene, ethane, acetylene, and methane confirm previous indications that pollution is highest in the north Denver region, with best sites for greenhouses located south-southeast of the city. Ethylene will reduce carnation keeping life if 50 ppb exist for 24 hours at room temperature.

18242 APTIC NO. 36499

Hasegawa, T., A. Sugimae, J. Fujii, and Ken Matsuo

TRACE METALS IN SUSPENDED PARTICULATES (VII). *(Fuyu funjinchu no kinzoku seibun (dainanaho)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):215, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

To determine the atmospheric iron concentration at 12 locations in Osaka City, particulate matter was collected using a high-volume air sampler and glass fiber by 24-hour sampling and analyzed by emission spectroscopy. The average iron concentration was 14.2 micrograms/cu and the concentration range was 0.31 196.5 micrograms/cu m. The particle-size distribution curve showed a peak at eight micron. The relationship between the iron concentration and the distance from the pollutant source, wind direction, or wind speed were examined. The iron concentration distribution pattern showed high concentration within three km downwind, while the concentration became about normal at 1.5 km in another area. The pollutant mainly consisted of ferric oxides. The result of x-ray diffraction analysis is also reported.

18243 APTIC NO. 37199

Hayakawa, M. and H. Mizutani

OBSERVATION FROM A TEN YEAR STUDY OF SULFUR DIOXIDE IN NAGOYA BY PB2 METHOD. *(Saikin 10-nenkan no Pb02hosoku teika ni yoru Nagoya-shi no aryusan gasu osen no kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):204, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The sulfur dioxide concentrations measured by the lead dioxide method for the past 10 yrs in Nagoya City were analyzed by dividing the city into five regions. The rate of increase in SO2 concentration was in the range of 1.48 2.56, and the rate of increase was higher in the less polluted region. The seasonal variation indicated that the concentration was higher in winter than in summer, with the exception of the western region. The summer/winter ratio of SO2 concentration was in the range of 0.55 to 0.58. The concentration distributions are illustrated by diagrams. As for the atmospheric diffusion, the concentration was a linear function of distance.

18244 APTIC NO. 36910

Hoshika, Yasuyuki, Tomohiko Ishiguro, Yoshiyuki Katori, Shinobu Futaki, and Yoshihiro Shigeta

AN EXAMPLE OF INVESTIGATION METHODS FOR ODOR POLLUTION. *(Akushu kogai chosa no jirei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):227, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Upon complaints from residents in the surrounding area of a small scale doll manufacturing plant, the odor concentration was measured by the organoleptic panel technique and the odor syringe method. The odorant concentration was measured by gas chromatograpy. Thy paint thinner and styrene type odors were detected, and the odor concentration was 10-300 at the source and 2-10 in the surrounding area. Methyl, ethyl, and n-butyl acetates, toluene, benzene, and ethylbenzene were identified, however, the concentrations were below the positive perception level.

**18245 APTIC NO. 36531**

**Kato, T., T. Sugimoto, and S. Nagarewari**

**A SURVEY ON MN PARTICULATE POLLUTION AND ENVIRONMENTAL IMPROVEMENTS.** *(Mn funjin osen no kankyo chosa to kaizen). Text in Japanese. Preprint, Association of Safety Engineering, Yokohama, Japan, p. 45-49, 1971. (Presented at the Association of Safety Engineering, Technical Meeting, 4th, Tokyo, Japan, Dec. 9-10, 1971.)*

Investigations were conducted on the air quality near the ferro-manganese refinery of the Toyama Electric Engineering Co., Namerikawa Plant. Emission of a large volume of dust containing manganese from two of three electric furnaces had been noted and complained about previously. Samplings of settling particles were taken from the rain troughs of houses at 118 locations covering an area of 12 sq km. Settling particles and air were sampled in controlled areas outside the limits of the test area. The maximum Mn concentration found was 56,000 ppm, averages in the marginal areas were 300 to 500 ppm and the total average was 4400 ppm. The contour line of the concentration distribution coincided with the anemograph chart. The amount of dust collected from the exhaust gases of three electric furnaces were 2200, 49,000, and 78,000 ppm respectively. The average index was 340 ppm in the controlled area. By the time the air quality was examined by high volume air samplers, electrostatic precipitators had been installed and the quality of the air had been greatly improved. Samplings from ten locations in each of the maximum, medium, and minimum polluted areas showed averages of 1300 micrograms/cu m, 0.160 micrograms/cu m, and 0.041 micrograms/cu m. respectively. Since then, improvements were made in dust collectors, and double skirts for furnaces and dust scattering prevention devices were installed, and a considerable improvement in the air quality has resulted.

**18246 APTIC NO. 36820**

**Kobayashi, Yo., M. Hori, N. Hashimoto, and Y. Furukawa**

**URBAN AIR POLLUTION BY LEAD - YOKOHAMA AND VICINITY.** *(Toshi taiki no namari osen ni tsuite - Yokohama-shi o chushin to shite). Text in Japanese. Preprint, Association of Safety Engineering (Japan), p. 39-44, 1971. (Presented at the Association of Safety Engineering, Technical Meeting, 4th, Tokyo, Japan, Dec. 9-10, 1971.)*

Air pollution by lead in the commercial-residential mixed areas of Yokohama was investigated with data collected since 1967, and comparisons were made with the records of less polluted areas. The lead concentration in the air was measured and relationships with other heavy metal pollutants were examined. Lead was measured by hi-vol samplers for 24 to 72 hr, and the chlorine solution of the collected lead was analyzed by polarograph and atomic absorption. The sampling location was on a 20 m high roof, 100 m from the main street of the city with an average traffic of 40,000 cars/day. Examination of the past records showed that the yearly average of Pb had been decreasing since 1968. Even during August through December when Pb concentration was expected to rise, it was relatively low, and the 1971 concentrations of Pb, copper, nickel, chromium, manganese, iron, and cadmium were all approximately half the amounts from the corresponding periods in 1970. This was probably the result of the Japanese Industrial Standard reducing the use of tetraethyl lead additive in high octane gasoline from 0.8 ml/l to less than 0.3 ml/l. The low lead content in all gasolines was noted since June 1970. The lead concentration in the air of the main street of relatively unpolluted Hachijo Island (average traffic 700 cars/day) was taken and was compared with that of Yokohama city. The former was 0.023 plus or minus 0.009 micrograms/cu m, and the latter was 0.33 plus or minus 0.096 micrograms/cu m. The correlation between Pb and Cd was high while that between Pb and Fe was low.

**18247 APTIC NO. 36474**

**Kubo, Kiyoshi, Eiichi Ito, and Masaru Kitase**

**ON CONTENTS OF SUSPENDED PARTICULATES IN THE ATMOSPHERE OF URBAN AREA.** *(Toshi taikichu ni okeru fuyu funjin seibun ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):210, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The vertical concentration distributions and hourly concentration variations of heavy metals in the atmosphere were measured in Nagoya City. Samples were collected by one hour sampling at ground level, 26, 50, 70, and 100 m above the ground from 8:00 to 20:00 on May 20 and 21, and June 8 and 9, 1971, and analyzed by the atomic absorption method. The vertical distribution of lead concentration is very similar to that of the suspended particulate matter, while the concentration distribution of iron, manganese, and copper was independent of the particulate matter. The concentration of Fe and Mn showed very similar distribution patterns. The cadmium concentration was almost constant, regardless of the altitude. The time variation of concentration showed higher values at rush hours, indicating the effect of auto exhaust. The effect of wind on the vertical distribution is also discussed.

**18248 APTIC NO. 37169**

**Laudien, Kurt**

**THE OUTDOOR AND INDOOR FREQUENCY DISTRIBUTION AND CONCENTRATION OF AEROSOLS.** *(Ueber die Groessenverteilung und Konzentration von Aerosolen in der Atmosphaere und in geschlossenen Raeumen). Text in German. Z. Physik. Chem. (Leipzig), 247(1/2):60-64, 1971. 21 refs.*

Indoor and outdoor aerosol concentrations on the outskirts of Greifswald were determined with scattered light particle counters. Ambient aerosol concentrations varied from 30,000-200,000 particles/l, while indoor limits were 30,000-600,000/l for particles above 0.3 micron. The distribution of particles above 0.3 micron conformed to the Junge exponential relationship. The average numerical value of Beta, which according to Junge should approach 3, was 3.11 for open air and 2.98 for enclosed space.

**18249 APTIC NO. 36808**

**Matsumura, Toshiro and Noboru Yamate**

**AIR POLLUTION AS MEASURED BY AUTOMATIC ANALYZER (VII).** *(Renzoku sokutei kirokukei ni yoru taiki osen ni kansuru chosa kenkyu (Dainanaho)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):193, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The atmospheric pollutant concentration due mainly to auto exhaust has been continuously measured at three locations in Tokyo since Jan. 1964. The data obtained during Jan. to Dec. 1971 are as follows: the yearly averages of 1-hour values are carbon monoxide, 4.5, 4.8, and 5.8 ppm (lower than the previous year); nitric oxide, 13.8, 10.0, and 14.3 pphm (higher than the previous year; nitrogen dioxide, 6.4, 3.9 and 6.0 pphm (higher than the previous year); sulfur dioxide, 6.4, 5.0 and 4.4 pphm (lower than the previous year); suspended particulate matter, 177, 224, and 151 micrograms/cu m at locations A, B, and C, respectively. The yearly average of 1-hour values at location C were formaldehyde, 0.70 pphm and hydrocarbons (as propane), 1.19 ppm.

*18250* *APTIC NO. 37202*

*Murata, M., K. Yoshida, H. Shima, T. Matsui, H. Hirobe, T. Kasamaru, K. Naka, T. Tsujikawa, T. Ishikawa, and K. Ishikawa*

*AIR POLUTION IN YOKKAICHI (I). (Yokkaichi no taiki osen (1)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):197, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The particulate pollutant concentrations were measured at five locations in Yokkaichi City in 1970. Samples were collected using a high-volume air sampler two to three times a month, and determined by spectrophotometry and the atomic absorption method. The avarage concentration at each of the five locations were in the following range (in micrograms/cu m): total particulate matter, 164-225; sulfate ion, 18.4-23.3; nitrate ion, 2.9-4.7; iron, 2.30-4.05; manganese, 0.11-0.19; lead, 0.18-0.33; copper, 0.05-0.08; vanadium, 0.06-0.11; titanium, 0.06-0.10; and nickel, 0.039-0.057. The maximum average values of each component are also given. An apparent correlation was observed between total particulate matter and SO4, and SO4 and vanadium.

18251 APTIC NO. 37191

Nagata, R., T. Hirono, H. Yamazaki, K. Asakuno, and T. Odaira

ON HEAVY METALS IN SUSPENDED PARTICULATE AND LOCAL CHARACTERISTICS IN TOKYO. *(Tokyo ni okeru jukinzoku osen ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):217, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The heavy metal concentrations at eight locations in Tokyo were surveyed from August 1969 to March, 1970. The lead, vanadium, chromium, nickel, cadmium, iron, manganese, and copper concentration in the particulate matter collected using a high-volume air sampler by 24 hour sampling were determined by the atomic absorption method. Of eight elements analyzed, the results of Pb and V determination are shown. The distribution pattern of Pb attributed to auto exhaust is quite different from that of V related to heavy oil combustion. The heavy metal concentrations during 1970 are almost the same as those in 1969.

18252 APTIC NO. 36486

Nakamura, M., K. Saruta, Y. Endo, and E. Yoneyama

TRACE METALS IN SUSPENDED PARTICULATES. *(Fuyu funjinchu no kinzoku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):214, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The metallic content in suspended particulate matter was measured at seven locations in Yokohama from May 10 to 18, 1971. Samples collected using a high-volume air sampler by 24-hour sampling were analyzed by the atomic absorption method. The concentrations of eight metals determined were in the following range micrograms/cu m: vanadium, 0.023-0.156; copper, 0.035-0.158; lead, 0.243-0.458; manganese, 0.211-0.529; cadmium, 0.119-0.079; nickel, 0.023-0.350; chromium, 0.016-0.105; and iron, 19.9-44.3. The Pb concentration attributable to auto exhaust was generally lower than that of the previous year. The nickel concentration was extremely high in the Tsurumi industrial district, almost ten times of that in the residential district. Vanadium and all the other metal concentrations were highest in Tsurumi district.

18253 APTIC NO. 36504

Nakazawa, M., Y. Saiki, S. Kanno, T. Koshimizu, K. Takamatsu, and Y. Sekiguchi

STUDIES ON AUTO-EXHAUST GAS POLLUTION IN KANAGAWA PREFECTURE. *(Jidosha haishutsu gasu ni yoru issanka tanso no koichi osen chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):234, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The carbon monoxide concentration at 40 intersections was measured four times during a year. Samples were collected by eight one-hour samplings from 10:00 to 18:00, and analyzed by infrared spectroscopy. The average of eight-hour sampling was most frequently in the range of five to ten ppm. The variation in CO concentration with time was not clear; however, a slight increase was noted during the period of 17:00-18:00. The CO concentration at a given intersection tended to be higher at the spot closer to the road.

18254 APTIC NO. 36181

Nemenko, B. A.

ON THE 3,4-BENZPYRENE CONTENT IN THE ATMOSPHERE OF BIG INDUSTRIAL CENTERS OF KAZAKHSTAN. *(O soderzhanii 3,4-benzpirena v atmosfernom vozdukhe krupnykh promyshlennykh tsentrov Kazakhstana). Text in Russian. Tr. Kaz. Nauch: Issled. Inst. Onkol. Radiol., vol. 3:46-48, 1967. 6 refs.*

The concentration of 3,4-benzopyrene in the atmosphere of several Russian towns was studied taking into consideration the concentration of industry, traffic intensity, and other factors. Taking of samples of air was done by the aspiration method. Qualitative determination of 3,4-benzopyrene was accomplished by means of fluorescence spectrum at room temperature and quantitative determination was done photoelectrically at liquid nitrogen temperature. Both standards and samples were measured in their n-octane solutions using 1,12 benzopyrene as an inner standard. The degree of air pollution by 3,4-benzopyrene depends on output of industrial plants in the area, on traffic intensity, landscape character, the kind of fuel used for heating, season of the year, and other factors. Different values obtained for 3,4-benzopyrene content at different locations are discussed in terms of these. Some prospects and possibilities of limiting pollution of the atmosphere by 3,4-benzopyrene are suggested.

18255 APTIC NO. 36844

Nishikawa, Yoshinori, Toshihiro Okuno, and Toru Fujii

ON THE ATMOSPHERIC CONCENTRATION OF POLYCYCLIC HYDROCARBONS IN URBAN AREA. *(Toshi taiki chu no takan hokozoku tanka suiso nodo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):208, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The concentrations of benzo(a)pyrene, benzo(a)anthracene, benzo(a)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, and perylene were measured at two locations, A (commercial area) and B (industrial area) in Osaka once a week during 1969 and 1970 by the following procedures: sampling (9:30-17:30) using a high volume air sampler, vacuum sublimation extraction, separation by thin-layer chromatography, and determination by fluorimetry. Benzo(a)pyrene concentration was highly related to the other hydrocarbons. Data are given by the midpoint values.

18256 APTIC NO. 36281

Pason, Anna and Dorata Tomala

DIURNAL CHANGES OF THE SULFUR DIOXIDE CONCENTRATIONS IN THE UNIVERSITY DISTRICT OF GLIWICE DURING THE SPRINGTIME. *(Dobowe stezenia dwutlenku siarki w dzielnicy akademickiej w Gliwicach w okresie wiosennym). Text in Polish. Zesz. Nauk. Politech. Slaskiej, Ser. Inz. Sanit., 17(305):25-30, 1971. 5 refs.*

Concentration of sulfur dioxide in the air of the university area in Gliwice, Poland, was determined in a three week continuous study utilizing a polarographic-coulometric analyzer. Concentrations of SO2 varied considerably in the course of 24 hours both due to the change in intensity of emission source exhalates and due to change in meteorological conditions. The velocity and direction of the wind were measured. Analysis of changes in wind direction and velocity during the 24 hour cycle led to conclusions on atmospheric turbulence. Concentration of SO2 was then analyzed in dependance on wind velocity and direction. The daily cycle of SO2 concentrations can be interpreted in terms of the daily cycle of parameters of atmospheric turbulence.

18257 APTIC NO. 36193

Robison, E. B. and G. W. Forbes, Jr.

SOOT EMISSION FROM RESIDENTIAL DISTILLATE OIL BURNERS IN MARYLAND. *Maryland State Dept. of Health and Mental Hygiene, Baltimore, Div. of Air Quality Control, 25p., Aug. 1971. 4 refs.*

A survey of soot emission from residential oil burners in the Baltimore Metropolitan Area was conducted during April and May of 1971 by the Division of Air Quality Control, while a similar survey was conducted in the Washington Metropolitan Area during February and March by the Montgomery County Health Department. The test team consisted of a Public Health Engineer and an Environmental Health Aide. Percent carbon dioxide, smoke number, flue draft, and flue gas temperature were measured. The best way to reduce pollution from these burners is to insure that all burners are properly adjusted to a zero to one smoke and a maximum CO2 percentage.

18258 APTIC NO. 36845

Saijo, T., T. Tsujimoto, and T. Takahashi

ODOR POLLUTION OF KASHIMA DISTRICT. *(Kashima chiku no akushu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):222, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The odor concentration at 16 pollutant sources and 30 surrounding locations in Kashima industrial district was measured from May 1970 to Feb. 1971. The concentrations of possible pollutants, such as hydrogen sulfide, mercaptans, other sulfides, lower hydrocarbons, sulfur dioxide, and ammonia were also measured. The dominant ordorants at the pollutant source, oil refineries and petrochemical plants, were hydrogen sulfide and mercaptans with high concentrations such as 20 ppm and 130 ppm, respectively. The odor concentration was 2400. The odor from the sewage treatment plant was extremely complicated with a high odor concentration of 4560. Trace or small amounts of H2S, NH3, methyl mercaptan, benzene, and chloroform were detected. In the surrounding area, the odor concentration was 60, and the SO2 concentration was 0.01-0.02 ppm, though a trace amount of H2S and 130 ppm of mercaptan were detected.

18259 APTIC NO. 36502

Sofuku, Masataka, Isao Koyama, Yoshiharu Iwasaki, Tetuhito Komeiiji, and T. Odaira

STUDIES OF CO PROFILE AROUND THE CROSSROADS. *(Kosaten shuhen no issanka tanso chosa hoho no kento). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):233, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The vertical distribution of carbon monoxide concentration was measured at Shimpo-cho intersection. The variation in CO concentration with the distance from the ground surface was not definite. To evaluate the effect of sampling spot at a given intersection, ten spots at the Koba intersection were selected for the sampling. The CO concentration showed marked difference from one spot to the other. Samples were collected with a diaphragm pump and analyzed by infrared spectroscopy on September 25, 1970.

18260 APTIC NO. 36408

Stratmann, H. and E. Herpertz

DUST FALL MEASUREMENTS IN THE STATE OF NORDRHEIN-WESTFALEN FROM OCTOBER 1, 1967 TILL SEPTEMBER 30 1968. *(Staubniederschlagmessungen im Lande Nordrhein-Westfalen vom 1.10.1967 bis zum 30.9.1968). Text in German. Schriftenreihe Landesanstalt Immissions- und Bodennutzungsschutz Landes Nordrhein-Westfalen, (Essen), vol. 15:39-94, 1969. 7 refs.*

In compliance with legal provisions, dust fall has been measured in the state of Nordrhein-Westfalen by 4978 stations since 1963 by the Bergerhoff method. Dust fall samples are collected monthly, thus most stations yield 12 data a year, except for stations which were destroyed or stolen. Dust fall quantities in the heavily industrialized Ruhr area situated between Duisburg and Dortmund amounted to 312,000 tons in 1963/64, 312,000 tons in 1964/65, 279,000 tons in 1965/66, 245,000 tons in 1966/67, and 251,000 tons in 1967/68 calculated from median dust levels. Results of the measurements are entered on maps divided into squares – each square covering an area of one or four sq km served by one measuring station. The various dust fall levels are represented by circles of five different diameters designating yearly median dust fall levels from 0.42 g/sq m to 1.31 g/sq m or by dots of different colours designating maximal median monthly dust fall levels from 0.65 g/sq m to 2.01 g/sq m. Yearly dust fall levels in various areas over the entire five year period are compared graphically by means of curves.

18261 APTIC NO. 36414

Stratmann, H. and S. Kuelske

SMOG ALARM SERVICE IN NORDRHEIN-WESTFALEN FROM OCTOBER 30, 1967 TILL OCTOBER 27, 1968. *(Smogwarndienst im Lande Nordrhein-Westfalen vom 30.10.1967 bis zum 27.10.1968). Text in German. Schriftenreihe Landesanstalt Immissions- und Boden-nutzungsschutz Landes Nordrhein-Westfalen (Essen), vol. 15:7-38, 1969. 4 refs.*

Measurement results of sulfur dioxide levels gathered during the fifth year of the continuous air quality monitoring program by 13 stations (Duesseldorf, Duisburg, Oberhausen, Bottrop, Essen-Mitte, Essen-Sued, Gelsenkirchen, Wanne-Eickel, Recklinghausen, Bochum, Castrop-Rauxel, Dortmund, Hagen) are presented in the form of tables and graphs. For the first time, SO2 emission levels exceeded those of the preceding four years, but they still did not reach the alarm level concentration. A multiple regression analysis disclosed that the emission levels during all of the five years were decisively affected by the weather. In the year under report, the highest median hourly SO2 concentration measured was 1.72 mg/cu m, well below the alarm concentration of 2.5 mg/cu m. In no instance did the yearly emission levels exceed the emission limits of 0.40 mg SO2/cu m and 0.75 mg SO2/cu m. Fourstations exceeded the maximal median monthly permissible level of 0.75 mg SO2/cu m twice, six once. Atmospheric inversions favoring increased SO2 concentrations were recorded during 32 days. The median SO2 emission level of all stations was by 23% higher than that of the preceding year.

18262 APTIC NO. 36849

Suzuki, Hiromi, Yoshikazu Kusuya, and Kikuo Oikawa

CONCENTRATION OF VANADIUM IN ATMOSPHERIC PARTICULAR MATTER. *(Taikichu banajiumu nodo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):220, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The vanadium in the atmosphere is largely attributed to heavy oil combustion. The relationship between the V concentration and the concentration of atmospheric particulate matter was investigated at six different locations, Ichihara City, Ohta-ku in Tokyo, Nagoya City, Tokuyama City, Kitakyushu City, and Ohita City. The particulate matter was collected on glass fiber filters using a high-volume air sampler, and the V concentration was determined by emission spectroscopy. The logarithmic plotting of V concentration versus particulate matter concentration indicates the correlation between these two concentrations in the case of a large city. In the case of newer industrial towns, however, there seems to be no correlation between them.

18263 APTIC NO. 36503

Tada, Osamu and Kenji Nakaaki

ON THE AIR POLLUTION IN SUBTERRANEAN PARKING PLACE. *(Chika shushajo no kuki osen ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):235, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead compounds in subterranean parking lots A and B, and CO in the exhaled air and Pb in the urine of attendants were determined in June and February, respectively. At parking lot A, the CO concentration was 13 31 ppm, NO2 was 0.05-0.09 ppm, SO2 was 0.02-0.07 ppm, and Pb was 4.5-12.4 micrograms/cu m. At parking lot B, the CO concentration was 7.0-40 ppm, NO2 was 0.01-0.05 ppm, SO2 was 0.03-0.08 ppm, and Pb was 0.3-1.1 micrograms/cu m. The CO in the exhaled air tended to increase with the duration of working. The average Pb concentration in urine was 28 micrograms/l and 20 micrograms/l at A and B, respectively.

18264 APTIC NO. 36806

Tairafune, K., A. Sato, W. Nakano, and M. Takahashi

INVESTIGATION ON THE AIR POLLUTION IN MIYAKO DISTRICT. *(Kwateken Miyako chiku no taiki osen ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):191, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The concentrations of sulfur dioxide, nitric oxide, nitrogen dioxide, hydrogen fluoride, suspended particulate matter, and its metal components (cadmium, manganese, copper, and lead) were measured at six locations in Miyako City for seven days in Aug. 1970. The maximum SO2 concentration was 0.095 ppm, however, 98% of the measured value was less than 0.05 ppm. The mean NO and NO2 concentration was 0.01 ppm except at one location, which was presumably attributable to the effect of wind direction. The mean HF concentration was 1.6 ppb, and the mean concentrations of metallic components were (in micrograms (cu m): Cd, 0.11-0.15; Mn, 0.11-1.11; Cu, 0.10-0.84 Pb, 0.06-0.93.

18265 APTIC NO. 36449

Teer, Ellis H.

ATMOSPHERIC LEAD CONCENTATION ABOVE AN URBAN STREET. *Washington Univ., St. Louis, Mo., Dept. of Civil and Environmental Engineering, Thesis (M.S.), Jan. 1971, 74p. 43 refs.*

The concentration of lead in particulates in the atmosphere above an urban street in St. Louis was measured by high-volume sampler and determined through atomic absorption spectrophotometry. The results were correlated with traffic volume, wind speed and direction, and elevation, and the total was regressed using multiple regression analysis. Lead concentration decreased with increasing elevation and was influenced by high-rise buildings. Traffic volume did not have as pronounced an effect on atmospheric lead concentration as was anticipated. (Author abstract modified)

18266 APTIC NO. 36195

Tepper, L. B.

SEVEN-CITY STUDY OF AIR AND POPULATION LEAD LEVELS. AN INTERIM REPORT. *Cincinnati Univ., Ohio, Dept. of Environmental Health, Air Pollution Control Office Contract PH 22-68-28, 8p., May 1971.*

In 1968, the Department of Environmental Health at the University of Cincinnati initiated a study which was designed to examine air lead levels at a number of locations in Cincinnati, Los Angeles, and Philadelphia. Instrument stations were re-established at the original sites of a previous study made in 1961-1962; identical equipment and filter media were used. Additional sites were located in Okeana, Ohio; Ardmore and Wynnewood, Pennsylvania; and Los Alamos, New Mexico. Blood samples were collected from volunteers from church and civic groups who had lived within a prescibed area for a period of at least five years. In association with the collection of the blood samples, subjects were interviewed with respect to age, place of residence, food and water supply, local travel, occupation and place of work, tobacco consumption, and health history. Rural and urban (commercial, residential, and industrial) areas were studied.

18267 APTIC NO. 36288

Tomida, B., T. Fukuda, H. Inoue, N. Hamamura, K. Ishida, M. Noma, Y. Shimizu, K. Nakamura, M. Hayakawa, and S. Watanabe

THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE. *(Aichi-kenka shuyo toshi no okeru taikichu no jukinzoku seibun ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):213, 1971. (Presented at the National Council of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

To investigate the effect of the Nanbu industrial district and rapidly growing Kinuura industrial district on the surrounding area in Nagoya, the atmospheric concentrations of heavy metals were measured at 12 locations from November 4, 1970 to January 12, 1971. Samples collected using a high-volume air sampler by 24- hour sampling were analyzed by the atomic absorption method. The average concentrations at five districts were in the following range (in micrograms/cu m): suspended particulate matter, 0.203-0.774; iron, 6.2-29.1; zinc, 1.0-5.5; copper, 0.10-5.1; manganese, 0.27-1.75; lead, 1.1-5.1; and cadmium, 0.011-0.034; the metallic concentrations were the highest in Nanbu district, followed by Kinuura district, however, the concentrations were significantly lower in other districts.

18268 APTIC NO. 36843

Toyoshima, K., K Sato, A. Hiramatsu, H. Soga, Y. Toya, T. Fukuda, H. Inoue, N. Hamamura, K. Ishida, T. Tomita, K. Tsuchihira, S. Takeuchi, M. Hayakawa, and H. Mizutani

THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA. *(Nagoya-shi shuhen ni okeru yuo sankabutsu no genkyo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):202, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The sulfur dioxide concentration was measured by the lead dioxide method at 293 locations in Nagoya City from June 1970 to July 1971. The 1.0, 1.5, 2.0 and 3.0 mg isoconcentration curves were drawn and analyzed by seasons. The seasonal variation of isoconcentration patterns was similar to the behavior of seasonal wind. The correlation and regression among seasons are discussed, which indicates the higher predictability in winter.

18269 APTIC NO. 36850

Tsuji, M., T. Okuno, and N. Takada

ON THE CONCENTRATION OF AMINE AND ALDENYDE COMPOUNDS FROM FISH-MEAL PLANTS.

*(Gyoshokotsu kasei kojo yori hassei suru amin oyobi arudehido kagobutsu no nodo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):226, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Bad odors at a fish-meal plant are known to be attributable to amines and aldehydes. Samples collected at plant A equipped with a malodor control tower and the ozone oxidation method, plant B equipped with another type of control tower, and locations within 300m from the odor source were analyzed by gas chromatograpy. Acetoaldehyde, propionaldehyde, iso-butyl aldehyde, diethylamine, n-butyl aldehyde, and n-butylamine concentrations were in the range of 0.2-1.2 ppm at plant A. High aldehyde concentration is attributable to the oxidation of amines by ozone. At plant B, methylamine, diethylamine, and n-propylamine concentrations were in the range of 0.28-0.63 ppm. Traces of ammonia and hydrogen sulfide were detected at both plants, Malodrant concentrations decreased with the distance from the odor source.

18270 APTIC NO. 36909

Umehara, Koichi, Mineo Umezawa, Takehiko Suzuki, Taturo Asaoka, and Mituru Endo

AIR POLLUTION CAUSED BY EXHAUST GAS OF AUTOMOBILES IN SHIZUOKA PREFECTURE. *(Shizuoka ken ni okeru jidosha haigasu ni yoru taiki osen chosa kekka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):230, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The concentration of carbon monoxide, nitrogen oxides and lead compounds and traffic volume were analyzed at intersections in six cities in Shizuoka Prefecture. The samples collected from 9:00 to 17:00 hours were analyzed by gas chromatography and the atomic absorption method. The concentration of CO was 2.5-12.3 ppm, NOx was 0.011-0.064 ppm, and Pb was 1.66-4.75 micrograms/N cu m. The equations expressing the relationship between the CO concentration and traffic volume were derived.

18271 APTIC NO. 36412

Vlodavets, V. V.

MOLD FUNGI IN THE AIR OF MOSCOW. *Priroda (Moscow), no. 12:95-97, 1956. Translated from Russian. Fort Detrick, Fredrick, Md., Technical Information Div., 4p., July 1, 1968.*

NTIS, DDC: AD 673310

During 1955, a quantitative and qualitative analysis was conducted on the mold fungi in the air of Moscow. Samples were taken twice weekly, between two and three p.m. A total of 96 samples were taken. The two methods used for bacteriological analyses were Krotov s slit sampler and Koch s dish method. Each investigation consisted of seeding the air onto two dishes containing beer wort agar, both by the slit sampler and the sedimentation method. The air samples were taken at a height of one meter 20 centimeters above ground level. The determination of the number of colonies of mold fungi and their identifications was made after incubation of the Petri dishes for five days at 22-24 C. Of the mold fungi found in the air, those most frequently detected were Cladosporium, Penicillium, Alternaria, and Aspergillus. The mold-fungi spore content in the air is affected strongly by meteorological factors. The study showed that in the various seasons of the year, there are significant quantitative and qualitative flucuations in the content of mold-fungi spores in the air.

18272 APTIC NO. 36293

Yamane, Yasuhiro, Motoichi Miyazaki, Kazuo Sakai, Tsuyoshi Imahashi, Shoji Bando, Yukio Murakami, Shin Kaji, and Michio Ito

STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS. *(Taiki osen ni kansuru kinzoku no kenkyu (daisanpo) hoshaka bunsekiho ni yoru koka baijin-chu no tetsu, aen, kuromu, kobaruto, anchimon oyobi sukanjiumu no sokutei to sono chiiki ni yoru hendo ni tsuite). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 17(6):387-392, Dec. 1971. 3 refs.*

Radioactivation analysis, which is a characteristic method for a non-destructive analysis, was applied for the measurement of metal components in the deposits collected mainly in the Kei-yo industrial zone (Chiba Prefecture). The method was tested for intermediate and long-lived radioisotopes of metals such as iron, zinc, cobalt, antimony, and scandium; the method was applicable for their measurements in addition to the determination of aluminum and manganese. The geometrical variation in the amounts of these elements in the deposits was also discussed from the analytical data of these elements. The amount of iron in the deposits was influenced by the iron works near the sampling point. In addition, a large amount of zinc and cobalt was also estimated in iron-rich deposit samples, and this was due to the iron works. However, a clear relation between the amount of chromium and the iron works was not observed. The amounts of antimony and scandium determined in this study showed no geometrical fluctuations.

18273 APTIC NO. 37186

Yasuno, S., J. Hayashi, K. Koike, S. Shibata, and K. Nakamura

INVESTIGATION OF AIR POLLUTION IN SOUTHERN AREA OF NAGOYA. *(Nagoya nanbu chiku kankyo taiki chosa ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):196, 1971. (Presented at the National Council 0Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

To investigate the sulfur dioxide concentration in a rapidly growing industrial area in southern Nagoya, samples were collected from 9:00 to 17:00 for seven days at a certain time of the year from 1966 to 1970, and determined by the p-rosaniline method. The SO2 concentration showed a decrease in 1968 and 1969, while the heavy oil consumption increased during the same period. The analysis in relation to the meteorological conditions revealed that the decrease in 1968 and 1969 were attributable to precipitation during that period. The yearly variation in sulfur trioxide concentration measured by the lead dioxide method are also shown.

18274 APTIC NO. 36168

Zutshi, P. K., R. Sequeira, T. N. Mahadevan, and Tapoti Banerjee

ENVIRONMENTAL CONCENTRATIONS OF SOME OF THE MAJOR INORGANIC POLLUTANTS AT THE BARC SITE, TROMBAY, BOMBAY. *Indian J. Meteorol. Geophysics, 21(3):473-478, July 1970. 11 refs.*

Aggregate monthly averages of some of the major inorganic pollutants in the atmosphere at the Bhabha Atomic Research Centre site at Trombay, India, over the past few years, are presented. This site is located about 10 km due northeast of the center of the city of Bombay. A thermal power plant, several oil refineries, a fertilizer unit, and several other chemical indistries are located on the western and southwestern sides of the Trombay site. Particulate matter, total dust load, benzene-soluble organics, and the water soluble and acid insoluble fractions were measured, as well as oxides of nitrogen, sulfur dioxide, and total oxidants. Seasonal wind data are also cited. The nitrogen oxides concentration from automobiles was low, since few automobiles are found at the outskirts of the city and since some are converted to peroxyacetyl nitrate. Maxium concentrations occurred in the spring and summer.

18275 APTIC NO. 36237

Zutshi, P. K., R. Sequeria, T. N. Mahadevan, and Tapoti Banerjee

AIR POLLUTION STUDIES IN TROMBAY REGION. *Preprint, Bhabha Atomic Research Centre, Bombay (India), Health Physics Div., p. 365-396, 1970. 24 refs. (Presented at the COST Seminar on Pollution and Human Environment, Bombay, India, Aug. 26-27, 1970.)*

An inventory of the major sources of air pollution in greater Bombay is presented, as well as the general wind characteristics in the region. Trombay is in the outskirts of greater Bombay. Improvements and modifications in some of the existing analytical procedures for the estimation of important inorganic pollutants of the atmosphere are briefly described. These include the West-Gaeke method, lead peroxide method, colorimetry, Saltzman method, and iodimetry. Results of measurements of concentrations of a few particulate and gaseous contaminants in the atmosphere during the past few years in and around the Trombay region are presented. The role of oxidants and other factors governing the conversion of gaseous sulfur oxide in the particulate form is briefly discussed. Suspended particulates, sulfur dioxide, and the oxidants in the Trombay region have reached the concentration levels which are likely to have harmful effects on the local inhabitants, vegetation, and property. Hydrogen sulfide, nitrogen oxides, ammonia, sulfates, chlorides, oxidants, and sulfur dioxide were measured. (Author abstract modified)

## ATMOSPHERIC INTERACTION

18276 APTIC NO. 36079

National Oceanic and Atmospheric Administration, Rockville, Md., Atmospheric Div.

GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE. *Program Plan 71-1, 24p., Feb. 1971.*

NTIS: Com-71-00307

A plan is presented for global monitoring of inadvertant modification of weather and climate by humam activities. Data acquisition and monitoring include global baseline land station observations, regional land station observations, oceanic baseline observations, and high altitude sampling and sensing. Heat balance, contaminant cycles, and emission rates would be determined. Geophysical modeling is included. Support activities involve a quality control system and data archiving. Coordination among national and international agencies is noted. The plan includes the cost estimate of achieving the programmed goals over five phases, each approximating a fiscal year. 0

18277 APTIC NO. 36422

FISCAL YEAR 1970 SUMMARY REPORT OF DIVISION OF METEOROLOGY SUPPORT TO THE AIR POLLUTION CONTROL OFFICE, ENVIRONMENTAL PROTECTION AGENCY. *National Oceanic and Atmospheric Administration, Raleigh, N. C., Air Resources Lab., 4320000/E18102220, NOAA-TM-ERL ARL-27, 80p., Feb. 1971. 23 refs.*

NTIS: COM-71-00472

A summary is presented of meteorological research and other projects which are being conducted by the Division of Meteorology for the Air Pollution Control Office. Various projects which are mentioned include the following: diffusion modeling and air pollution prediction models, wind and water tunnel models; air pollution forecasting and climatology, the development of radiometric thermasonde techniques, acoustic sounding systems, and laser probing techniques; source studies, plume behavior, sulfur dioxide fate, trajectory studies, and mixing height determinations; long-term geophysical and biological effects; abatement and control, and support to other Air Pollution Control Office programs; internation cooperation.

18278 APTIC NO. 36142

Aleksandrov, E. L., L. M. Levin, and Ju. S. Sedunov

ON THE GROWTH OF DROPLETS BY CONDENSATION ON HYGROSCOPIC NUCLEI. *Tr. Inst. Eksp. Meteorol., no. 6:16-96, 1969. 9 refs. Translated from Russian by C. Long, National Lending Library for Science and Technology (England), 7p.*

Numerical calculations made so far do not give a detailed picture of the growth of small particles since they take no account of factors such as the structure of a nucleus and the amount of soluble matter in it. Because these factors are important in the study of the condensation stage in the development of cloud spectra, detailed calculations were made on the basis of an equation describing the growth of droplets by condensation on hygroscopic nuclei. The results show that the growth of droplets on hygroscopic nuclei is appreciable even at humidities of 80-90% and that very small changes in relative humidity can play a significant role in the subsequent growth by condensation of nuclei from 0.5-one micron. Even when the necessary conditions for cloud or fog formation are absent, nuclei can increase their radii by a factor of two or three and produce great changes in atmospheric optical properties. If humidity departs by 0.01% from 100%, growth of 0.5-one micron particles may either cease because the equilibrium radius is reached or may continue indefinitely.

18279 APTIC NO. 36073

Aynsley, Eric

COOLING TOWERS, THE ENVIRONMENT AND THE FUTURE. *Preprint, Cooling Tower Inst., 11p., 1970. 3 refs. (Presented at the Cooling Tower Institute, Semi Annual Meeting, Aspen, Colo., June 22-25, 1970.)*

Until recently, mechanical draft towers have been used exclusively in the United States for cooling electric power generation process water. Natural draft towers, which have been very popular in Europe for decades, are only now becoming popular in this nation. Current projections indicate that between 32 and 42 towers will be built within the next two to three years. To date all of the operational hyperbolic towers are associated with coal-fired steam electric stations, although future towers will be associated with nuclear stations. Field studies were performed at the Keystone Generating Station near Shelocta, Pennsylvania, to determine the possible environmental effects of four natural draft towers. Heat and water balances were performed over the towers and aerial monitoring of humidity, temperature, and sulfur dioxide was performed using a Bell J2 helicopter. Tower plumes were cooler than the ambient air; this negative buoyancy caused the plume to lower with downwind distance. Hyperbolic towers have much larger point emissions of heat and water vapor and certainly have the potential to form dense, extensive fogs. Hyperbolic tower plumes puncture and ventilate natural inversions and obtain greater heights than mechanical tower draft tower plumes.

18280 APTIC NO. 36147

Aynsley, Eric

ENVIRONMENTAL ASPECTS OF COOLING TOWER PLUMES. *Preprint, Cooling Tower Inst., 10p., 1970. 6 refs. (Presented at the Cooling Tower Institute Meeting, New Orleans, La., Jan. 27-28, 1970.)*

Natural-draft cooling towers present an attractive alternative heat-disposal technique in the electric utility industry. One aspect of major environmental importance in connection with these towers is inadvertent weather modification. Preliminary test data from a coal-fired power station with four 325-ft hyperbolic towers indicate that local fogging and icing is not a problem: the tower plumes puncture and ventilate natural inversions and attain greater heights than mechanical-draft tower plumes. Under stable conditions with higher humidities, plumes appear downwind as stratus cloud coverage, or merge and reinforce existing cloud coverage. Initiation of cumulus clouds is a rare occurrence. A 27% increase of local evaporation due to tower precipitation can occur, but this is small compared with humidity changes associated with natural air movements. Mixing of tower and chimney stack plumes is a frequent occurrence. The acid drop concentration increases with humidity, confirming the dependence of sulfur dioxide oxidation to sulfuric acid on humidity.

18281 APTIC NO. 36428

Boeer, W.

THE APPLICATION OF METEOROLOGICAL DATA IN TOWN PLANNING, IN RELATION TO PROBLEMS ON AIR POLLUTION. *(Die Anwendung meteorologischer Unterlagen bei der Stadtplanung in Hinsicht auf Problem der Luftverunreinigung). Text in German. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 79-81. 3 refs. (Oct. 4-7, Paper III/14.)*

The application of meteorological data to the problem of air pollution in towns is reviewed. Air resource management and air pollution forecasting are examined with respect to statistical analyses of temperature inversions at ground level, structure of the wind field, and diffusion models.

18282 APTIC NO. 36252

Burton, W. M. and N. G. Stewart

USE OF LONG-LIVED NATURAL RADIOACTIVITY AS AN ATMOSPHERIC TRACER. *Nature (London), 186(4725), May 21, 1960. 15 refs.*

The distribution of radium (D), radium (E), and radium (F) in air and rainwater was investigated in the United Kingdom. These daughter products of radon are naturally present in the atmosphere as a result of the leakage of radon from surface soil and rocks. Ground-level and above ground-level air samples were collected in filters of esparto grass paper; rainwater samples were collected in polyethylene bottles. The isotopes were separated from fission products by solvent extraction of the dithizone complexes of lead and bismuth. The averaged concentrations of radium (D) determined by two methods were plotted against altitude to give the vertical distribution of the isotope. Atmospheric radium (D) concentrations increased with height above ground, with the gradient increasing sharply in the vicinity of the tropopause. Radium (F) varied from a low value at ground level to a high value in the lower stratosphere. The ratio of radium (F) to radium (D) was 0.13 at ground level and 0.65 at 45,000 ft. The isotope measurements are interpreted in terms of an atmospheric circulation model assigning both the troposphere and ascending air at the equator as sources of radium, (D). The use of radium (D) as a natural tracer in the study of atmospheric processes is proposed.

18283 APTIC NO. 36497

Chen, Chen Jie

ON THE ASCENT OF PILOT-BALLONS IN THE LOWER ATMOSPHERE. *(Kaso taikichu de no pairotto barun no josho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):129, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

To investigate the relationship between the motion of a pilot balloon and air currents, the motion equation of a balloon in terms of the drag force and buoyancy which are the functions of balloon velocity and wind speed is derived. The equation was solved in the case of a step-wise variation in wind speed. The result indicated the adequecy of a pilot-balloon for the measurement of wind direction and speed. The experimental result of the ascent velocity of a balloon indicates that the balloon characteristics are also a contributing factor to the change in ascent velocity, though the vertical current is the dominant factor.

18284 APTIC NO. 36882

Cheng, Robert T., Morton Corn, and John O. Frohliger

CONTRIBUTION TO THE REACTION KINETICS OF WATER SOLUBLE AEROSOLS AND SO2 IN AIR AT PPM CONCENTRATIONS. *Atmos. Environ., 5(12):987-1008, Dec. 1971. 27 refs.*

The heterogeneous catalysis of sulfur dioxide in the atmosphere was studied in the laboratory by measuring the rate of oxidation of sulfur dioxide to sulfuric acid in a flow reactor and in the presence of metal salt aerosols. Aerosol particles were deposited on Teflon beads that were packed into the reactor. Aerosols of manganous sulfate, manganous chloride, copper sulfate, and sodium chloride acted as true catalysts when catalytic oxidation of SO2 occurred within their aqueous solutions. Among the four salts tested, MnSO4 was most effective and NaCl the least effective. The overall rate of absorption and oxidation of SO2 by aqueous catalyst solution drops was limited by the chemical reaction itself. When a MnSO4 aerosol was used, the overall reaction rate was first order with respect to SO2 concentration in the gas phase. Higher rates of oxidation always accompanied higher relative humidities at an air temperature of 23 C and ambient air pressure of 740 mm Hg. Cupric chloride acted as a primary reactant with SO2; SO2 was oxidized to sulfuric acid while CuCl2 was reduced to CuCl. Based on extrapolation of laboratory results to an urban industrial environment, the rate of absorption and oxidation of SO2 by fog droplets in natural fog is 2%/hr.

18285 APTIC NO. 36215

Curcio, Joseph A.

EVALUATION OF ATMOSPHERIC AEROSOL PARTICLE SIZE DISTRIBUTION FROM SCATTERING MEASUREMENTS IN THE VISIBLE AND INFRARED. *J. Opt. Soc. Am., 51(5):548-551, May 1961. 8 refs.*

The atmospheric aerosol particle size distribution was examined using measured spectral scattering coefficients in the wavelength region of 0.40-2.27 microns. It was found that the aerosol on a particular day can be represented by a two-component composite, the main component having an exponential Junge distribution and the other having either a distribution of larger particles similar to that of aerosols found in maritime air or a relatively monodisperse distribution contained in a narrow radius interval. The results show that estimates of aerosol size distribution may be in error if based only on attenuation measurements in the visible region. The contribution of larger particles to the scattering coefficient is not apparent unless the infrared is also investigated. (Author abstract modified)

18286 APTIC NO. 36352

Decker, Fred W.

PROBABILITIES OF COOLING SYSTEM FOGGING. *Preprint, American Inst. of Chemical Engineers, New York, 6p., 1971. 3 refs. (Presented at the American Institute of Chemical Engineers, National and Petroleum and Refining Exposition, 6th, Houston, Tex. Feb. 28-March 4, 1971.)*

Probalities for cooling system fogging are discussed. Fog has the greatest chance of forming where a confined waterway serves to cool a power plant, since barriers to air movement foster evaporation to humidify the air at the surface. Two types of cooling towers have low but finite probability for forming fog: low-level mechanical-draft units emitting near the surface and older natural-draft units lacking drift eliminators. Most of the newer tall natural-draft towers have drift eliminators, and for these the probability of fogging is very low or remote. An exception would be the case of an installation whose visible plume joins the sulfur-bearing emissions of a smokestack. A world-wide survey of actual incidences of fogging caused by cooling towers is proposed.

18287 APTIC NO. 36810

Ebisawa, E., T. Takahashi, and Y. Tominaga

AIR POLLUTION OF HITACHI DISTRICT (REPORT 2). *(Hitachi chiku no taiki osen ni tsuite (Dainiho)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):192, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The sulfur dioxide concentration measured by the lead dioxide method and conductometric method at 16 locations in Hitachi during 1970 was analyzed in relation to the meteorological factors. The average SO2 concentrations were 0.36 mg (concentration was higher in summer) in the northern section, 0.83 mg (higher in winter) in the central section, and 0.51 mg (slightly higher in winter) in the southern section, which were related to the frequency of wind direction by season. Data were also analyzed in relation to the wind speed. The source of pollutants lies in the northern region. The 20% decrease in SO2 concentration measured in 1971 indicates the effect of control measures taken by the responsible industries.

18288 APTIC NO. 37201

Eriksen, Wolfgang

LOCAL CLIMATIC CONSEQUENCES OF URBAN DEVELOPMENT. *(Die stadtklimatischen Knosequenzen staedtebaulicher Entwicklung). Text in German. Staedtehygiene (Uelzen/Hamburg), 22(11):259-262, Nov. 1971. 5 refs.*

The large-scale climatic conditions are modified over the urban areas. The aerosol content of the urban atmosphere is the main cause for this. During calm weather conditions, above cities a haze layer forms containing solid, gaseous, and liquid emissions. Those cities whose topographical location reduces the horizontal and vertical air exchange are especially affected. The vertical exchange comes practically to halt with the formation of temperature inversions. The haze layer darkens the light in the city and reduces solar radiation. More than 50% of solar radiation can be lost by scattering and absorption in the haze layer. The short ultraviolet-waves are particularly reduced (by as much as 90% sometimes). The haze layer acts like a lid. The nightly cooling of temperatures in the urban areas is reduced. The average temperatures are higher in cities than everywhere else. For better ventilation of the urban areas, green belts must be created, more open space is needed; residential areas should be shielded from traffic by enough trees. Air polluting industries should be moved out of residential areas.

18289 APTIC NO. 36458

Feth, J. H.

CHEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE DESERT REGION, CALIFORNIA. *Geol. Survey Prof. Paper, no. 575-C:C222-C227, 1967. 7 refs.*

Analyses of 41 samples of bulk precipitation from 12 locations in the Mojave Desert region show wide ranges of dissolved-solids concentration and a variety of chemical types, although the calcium bicarbonate type water dominates. Specific conductance of the solutions analyzed ranged from 8.9 to 823 micromhos and shows strong inverse correlation with quantities of rain but no discernible correlation with time of exposure of the gage between samples. Dust that locally includes saline materials appears directly to govern the chemical type and concentration of a few samples. Bulk precipitation in the Mojave is closely similar to bulk precipitation sampled at Menlo Park, Calif., near the coast, in the San Francisco Bay area. (Author abstract)

18290 APTIC NO. 36397

Findlay, B. F. and M. S. Hirt

AN URBAN-INDUCED MESO-CIRCULATION. *Atmos. Environ. (London), 3(5):537-542, 1969. 7 refs.*

A weak centripetal wind system generated by the locally induced urban heat island was described. The process was demonstrated on a sunny day in mid-winter at the lake-side city of Toronto, Canada. The country wind at Toronto is induced by the anomolous temperatures of the urban heat island, and is a sufficiently powerful mesometeorological process to be detected by ordinary climatological stations at the time of maximum heating. The wind speeds and temperature anomalies observed on Feb. 23, 1966 were nearly of the same magnitude as those observed or calculated by Chandler, Berg, and Gold. The continuing study of such meteorological phenomena is of great importance if one is to obtain a better understanding of the urban air pollution problem. The influence of an urban-induced meso-circulation was discussed. It seems likely that on nights when the heat islands are intense, local, centripetal, and near-surface winds, strongest across the steep thermal gradient of urban margins, will affect the pollution pattern. The general consequence is to sharpen the pollution gradients between urban and rural areas and to encourage the vertical rather than the lateral dispersal of pollutants. Further studies are being undertaken in Toronto which incorporate the use of automobile traverses and pilot balloon flights in order to more accurately document the meso-scale processes associated with the urban heat island and other local features. (author conclusions modified)

18291 APTIC NO. 36410

Firket, J.

ABOUT THE CAUSES OF THE ACCIDENTS WHICH OCCURRED IN THE MEUSE VALLEY DURING THE FOG OF DECEMBER 1930. *(Sur les causes des accidents survenus dans la vallee de la Meuse, lors des brouillards de decembre 1930). Text in French. Bull. Roy. Acad. Med. Belg., vol. 11:683-739, 1931.*

For five days in December 1930, an intense fog covered part of Belgium. Several hundred people were gripped by sudden respiratory difficulties and many of them developed cardiovascular trouble. More than 60 persons died. Extensive investigations followed to establish details of the afflictions and to analyze their causes. Autopsies revealed diffuse congestion of the trachea and the bronchi. It became clear that the clinical symptoms observed were due to noxious products which did not act in the manner of real toxicants, but triggered a series of reflexes which eventually brought about death. No intestinal trouble or any other symptoms of intoxication occurred. The nature of fog formation, which can be enhanced by the presence of dust and smoke in the air, is discussed. During the critical period of this episode, an unusual meteorological situation fostered the mixing of noxious substances and gases emanating from chimney smoke with the air. The absence of winds and the persistance of the fog brought, within a few days, particles of 1 to 5-micron size close to ground level. The particles had little tendency to disperse, increasing the likelihood of inhalation by humans and animals. Various noxious substances which can be contained in smoke are discussed. In the case of the Meuse disaster, sulfur dioxide probably had an important contributory effect.

18292 APTIC NO. 36096

Fontan, J.

MEASUREMENT OF VERTICAL TRANSPORT OF NATURAL RADIOACTIVITY BY TURBULENT DIFFUSION. *(Mesure a l aide de la radioactivite naturelle du transfert vertical de matiere par diffusion turbulente). Text in French. Preprint, Faculte des Sciences de Paris (France), p. 1-19, 1968. 37 refs. (Presented at the Seminaire de Physique des Aerosols, Paris, France, 1968.)*

The natural radioactive elements radon and thoron which form in the soil and emanate into the atmosphere were used as indicators of the transport of materials by turbulent diffusion. Numerous measurements of the vertical distribution of natural radioactivity by means of fluorescent tracers and other methods yielded diffusion coefficients for different altitudes under different conditions. Diffusion coefficients near the ground must be determined with thoron on flat terrain of several square kilometers with uniform vegetation. Radon can be used up to an altitude of several thousand meters. The equations for diffusion and the diffusion coefficient are derived, various methods of determining atmospheric diffusion are described, and source problems inherent in the application of natural radioactivity to the calculation of diffusion (variability of radiation with the nature of the surface, with vegetation cover, and with humidity) are analyzed. Experimental arrangements involving the absorption of radon on active carbon, the determination of concentration gradients, and other procedures are described.

18293 APTIC NO. 36176

Fuquay, J. J. and Ch L. Simpson

USE OF METEOROLOGICAL MEASUREMENTS FOR PREDICTING DISPERSION FROM RELEASES NEAR GROUND LEVEL. *Commissariat a l Energie Atomique, Saclay (France), Centre d Etudes Nucleaires, Pollut. Radioact. Milieux Gazeux, Proc. Symp., Saclay, France, 1963, p. 115-122. 16 refs. (Nov. 12-16.)*

Meterological measurements were conducted for predicting dispersion from releases near ground level. The theoretical basis for summarization of exposure data in terms of travel time are reviewed. Results are presented for the decrease of maximum exposure and horizontal plume growth as a function of travel time. Prediction parameters are developed from meteorological measurements of vertical temperature profiles in the boundary layers and the wind speed and direction near release height. The local Richardson Number and the product of the wind speed and standard deviation of wind direction correlate well with the experimental data. A method is described for predicting exposures from protracted releases in which multimodal, flattened, or skewed distributions are often observed. (Author abstract modified)

18294 APTIC NO. 36062

Gedeonov, L. I. and O. A. Rys yev

USE OF COSMOGENIC RADIOISOTOPE MIGRATION PATTERNS IN THE STUDY OF THE PROPAGATION OF RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE. 1967 (?). *16 refs. Translated from Russian in: USSR Reports on Natural and Fallout Radioactivity, p. 263-287. Atomic Energy Commission, New York, Health and Safety Lab.*

NTIS: AEC-TR-7128

Concentrations of beryllium(7), phosphorus(32), and sulfur(35) in surface air and in fallout were sampled by filter at a Leningrad station for four years from 1963 to 1966. Radioisotope concentrations varied with the season, reaching a maximum at the end of May and a minimum in October of each year. These patterns changed, however, with increasing precipitation or intensified deposits of cosmogenic radioisotopes from the stratosphere. S(35) fallout in 1963 included a sizable contribution from experimental explosions. Both S(35) and Be(7) showed a high correlation with theoretical estimates of mean annual fallout based on the rate of formation of cosmogenic radioisotopes during periods of minimal solar activity. A sharp deviation from the theoretical was observed for P(32). An analytical formula was derived for the annual course of the three cosmogenic radioisotopes in surface air and a curve was obtained showing the boundary between the interval of decrease and the interval of increase of concentration. Matching of stratospheric replenishments of concentrations against synoptic special features showed that altitude cyclones are one of the fundamental causes for the penetration of significant masses of stratospheric air.

18295 APTIC NO. 36825

Graaf, H. de

GROUND FOG. *(Grondmist). Text in Dutch. Chem. Weekblad., 67(23):10-12, June 4, 1971. 20 refs.*

A survey of stable atmospheric conditions up to a height of 30-100 m and of 24 hr duration, and the increase in sulfur dioxide and smoke measurements in urban areas is presented. In the months of Nov. and Dec. 1969 and Feb. 1970, heavy fog conditions were reported. Data on SO2 and smoke during this period are presented. Also included are data on wind speeds and directions. The source of pollution was not chimneys of factories. The increased concentrations of pollutants is attributed to three factors: domestic heating using coal gas, automobiles using diesel engines, and fumes from oil-burning ships. A study should be made to use natural gas for automobile engines to reduce or eliminate air pollution.

18296 APTIC NO. 36058

Hanna, Steven R.

METEOROLOGICAL EFFECTS OF COOLING TOWER PLUMES. *National Oceanic and Atmospheric Administration, Oak Ridge, Tenn., Air Resources Atmospheric Turbulence and Diffusion Lab., 17p., 1971. 5 refs.*

The amounts of energy and moisture emitted to the atmosphere by cooling towers are compared to the production of energy and moisture by meteorological processes. The energy input from a large (1000 MW) power plant is a significant fraction of the energy production of mesoscale atmospheric phenomena such as thunderstorms. Methods for calculating the rise of cooling tower plumes and the possibility of cloud formation as a result of these plumes are described. Numerical experiments show that it is possible for clouds to form above cooling towers. Plume rise can be estimated using simple theory, but cloud depth and maximum water content cannot be easily estimated. It is possible, using the numerical model, to calculate the growth of the moist plume for a variety of different plumes and environmental temperature and humidity distributions. These methods can be applied to estimate the effects of cooling towers on the atmosphere at any location. Similar formulas can be used to calculate plume and cloud growth when the wind speed is greater than zero. The bases for all these formulas are the theory of plume rise from isolated stacks and the theory of cumulus cloud growth.

18297 APTIC NO. 36150

Hanna, Steven R.

SUMMARY OF MEETING ON MESOSCALE ATMOSPHERIC MODELLING (HELD JUNE 14-16, 1971 AT WATTS BAR DAM, TENNESSEE). *National Oceanic and Atmospheric Administration, Oak Ridge, Tenn., Air Resources Atmospheric Turbulence and Diffusion Lab., 21p., 1971. 22 refs.*

Abstracts are provided of nine papers presented at the Meeting on Mesoscale Modelling (June 14-16, 1971) and the recommendations of nine discussion groups are summarized. The papers concern mesoscale modelling at the National Meteorological Center; a single-layer mesoscale model; a seven-layer physical-numerical model for the lower troposphere; a planetary boundary layer model; mesoscale circulations; numerical modelling in three dimensions; physical modelling of mesoscale atmospheric motions; a numerical model of the nocturnal urban boundary layer; and a model that considers the presence or absence of geostrophic winds. A national center for the development of physical models is proposed together with close cooperation between mathematical and physical modelling and field experiments.

18298 APTIC NO. 36210

Henderson, Thomas J. and Donald W. Duckering

THE ILLINOIS TRACER EXPERIMENT - 1970. A SUMMARY REPORT OF ACTIVITIES CONDUCTED BY ATMOSPHERICS INCORPORATED. *In: Study of Rainout of Radioactivity in Illinois. (Ninth Progress Report). Illinois State Water Survey, Urbana and, Atmospherics Inc., Fresno, Calif., Atomic Energy Commission Contract AT(11-1)-1199, Nov. 1970, App. A, 21p.*

NTIS: COO-1199I9

Indium chloride tracers were released from aircraft during six thunderstorms between May 15 and June 30, 1970. Meteorological conditions prevailing when tracer materials were injected are reported along with observations on the growth of precipitation-producing cumulus cells. Particulate concentrations in the general aerosol are extremely important parameters in cell formation, but the water vapor and high humidity throughout the operational area prevented sorting out any relationship between nuclei and visibility. Where visibility allowed reasonably good aerial observations, new virgin currents were observed to grow on more sides and over wider areas of the total cell than cumulus cells observed in other areas in the U. S. and abroad. Ice and condensation nuclei concentrations in the operational area had wide variations in time and space. However, ice nuclei concentrations near cloud base were generally quite low compared to other areas.

18299 APTIC NO. 36345

Henson, E. B.

CHEMICAL CHARACTERISTICS OF PRECIPITATION IN CHAMPLAIN VALLEY. *Vermont Univ., Burlington, Dept. of Zoology, Dept. of Interior, Proj. A-7-65, 10p., June 1971. 1 ref.*

NTIS: PB 200167

More than 1000 precipitation water samples were collected from stations in the Champlain Valley (between the Green Mountains and the Adirondack Mountains) and chemically analyzed for the cations calcium, sodium, magnesium, and potassium; and for the anions of chlorine and sulfate. The median concentration for all samples were: Ca, 1.25; Na, 0.28; Mg, 0.20; K, 0.10; Cl, 1.7; and SO4, 1.9 mg/l. Higher concentrations were observed in winter months with the exception of SO4, which was lowest in winter. Median monthly loads were: Ca, 99; Na, 36; Mg, 15, K, 21: Cl, 134; and SO4, 147 kg/sq km. Precipitation brought down about 450 kg/sq km/month. Considerable variation existed between rains and between stations. In general, concentrations were higher in urban areas than in rural areas. The concentrations of the six ions, when compared with a high-elevation mountain pond, indicate more Cl in rainfall than in the pond water. (Author abstract modified)

18300 APTIC NO. 36347

Holzworth, George C.

VERTICAL TEMPERATURE STRUCTURE DURING THE THANKSGIVING WEEK 1966 AIR POLLUTION EPISODE IN NEW YORK CITY. *Preprint, Air Pollution Control Office, Research Triangle Park, N. C., Div. of Meteorology, 18p., 1971. 13 refs.*

Time cross sections are presented of vertical temperature structure during the Thanksgiving week 1966 air pollution episode in New York City, based on six-hourly rawinsonde flights at Kennedy Airport. The analyses depict numerous inversions in the lower 10,000 ft of the atmosphere, including an interesting sequence of surface-based inversions and an outstanding example of subsidence. Diurnal variations in the height of the mixing layer can also be seen. Some possible influences of the vertical temperature structure on sulfur dioxide concentrations in Manhattan are discussed. Exceptional peak SO2 concentrations may have been due largely to the fumigation process. (Author abstract modified)

18301 APTIC NO. 36483

Horiuchi, N., S. Suzuki, and W. Ando

PHOTOCHEMICAL REACTION BETWEEN SO2 AND ORGANIC COMPOUND (III). *(Aryusan gasu to yuki kagobutsu to no kokagaku hanno (III)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):114, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The photochemical reaction of a sulfur dioxide/butene-2/nitrogen system was investigated by varying the ratio of SO2/butene-2/N2 and using a reaction bottle equipped with a high-voltage mercury lamp. The reaction products were analyzed by gas chromatograpy. The plotting of SO2+butene-2 concentration (%) versus esomerization rate (%) showed a peak when SO2+butene-2 equaled one percent. At concentrations above one percent, the addition reaction becomes dominant, presumably due to the decrease in intermolecular distances, thus decreasing the isomerization reaction.

18302 APTIC NO. 36492

Ikeda, Y., M. Hiraoka, and H. Todaka

AIR POLLUTION OF URBAN SCALE AND METEOROLOGICAL FACTOR. *(Toshi sukeru no taiki osen to kisho yoso ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):127, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The high atmospheric pollutant concentration is often associated with the atmospheric stagnation causing the pollutant accumulation. Based on meteorological data and sulfur oxides concentration recorded in Osaka City, the relationship between the atmospheric purification effect and meteorological conditions was quantified by classifying atmospheric pressure distribution patterns into eight types. The derivation of mathematical equations for the purification effect as functions of wind and time is discussed.

18303 APTIC NO. 37198

Ishida, K., K. Toyoshima, N. Hamamura, B. Tomita, H. Suzuki, A. Takase, Y. Kawai, and N. Kawaguchi

ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE. *(Aichiken Atsumi hanto ni okeru taiki osen ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):195, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

To investigate the effect of industrial district in Nagoya on Atsumi peninsula located south of Nagoya, the sulfur trioxide concentration was measured by the lead dioxide method since June 1968 at five locations (now increased to 11 locations). The monthly variation in SO3 concentration measured at three locations from June 1970 to May 1971 showed remarkably similar patterns. The sulfur dioxide concentrations measured using an automatic analyzer at five locations since Dec 1970, also showed very similar values, in spite of the widely spread locations, indicating the pollutant source was located at a great distance. The analyses of pollutant concentrations in relation to wind direction and speed also pointed to Nagoya industrial district as the pollutant source.

**18304** **APTIC NO. 36308**

**Ito, M., S. Fukuoka, T. Odaira, H. Naito, K. Nakamura, and T. Sakurai**

**AIR POLLUTION FORECASTING PROGRAM.** *(Taiki osen (Konodo aryusan gasu) yoho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):122, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

For sulfur dioxide concentration forecasting, an equation based on the statistical model was developed. The data obtained during the six months, December 1969-February, 1970 and December 1970- February, 1971, at three locations in Tokyo were used. The joint correlation between the daily average $SO_2$ concentration and each meteorological element was obtained. Using factors with high correlation, low internal correlation, and high forecasting accuracy, a regression equation was derived. The $SO_2$ concentration was a dependent variable; the multiple correlation coefficient was 0.75. The predicted values obtained by the equation and the measured values were compared. The correlation coefficient between the predicted and measured values was 0.73.

**18305** **APTIC NO. 36112**

**Johnston, Harold**

**CATALYTIC REDUCTION OF STRATOSPHERIC OZONE BY NITROGEN OXIDES.** *California Univ., Berkeley, Lawrence Radiation Lab., Atomic Energy Commission Contract W-7405-eng-48, Rept. UC-4, TID-4500, 114p., June 1971. 49 refs.*

**NTIS: UCRL-20568**

Two types of quantitative calculations 0are presented to supplement other studies of the possible environmental impact of nitrogen oxide emissions from supersonic transport planes: (1) the rate of destruction of ozone by nitrogen 0oxides relative to the ozone destruction rate by the couple (0, 03) and by free radicals derived from water; and (2) steady-state calculations of the profile of ozone in the stratosphere for a wide range of uniform and non-uniform distrubutions of $NO_x$. The calculations cover the complete range from 0 to 100 ppb, with special emphasis on four cases with $NO_x$ at 3, 7, 30, and 70 ppb. Nitrogen dioxide and nitric oxide have a powerful effect in reducing ozone; 30 ppb, previously accepted as negligible, would reduce the ozone column by about a factor of two. Variable factors of large scale transport of air masses, subsidence, and molecular and turbulent diffusion complicate but do not eliminate the catalytic effect of NO and $NO_2$ on stratopheric ozone. (Author abstract modified)

**18306** **APTIC NO. 37211**

**Kachi, S., S. Oomichi, M. Itou, M. Suzuki, Y. Matsuura, T. Saito, K. Tsuchida, H. Yoda, and H. Yoshinari**

**THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.** *(Chibaken ni okeru kokaguku sumoggu hassei no genkyo). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):207, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The oxidant concentration at five cities in Chiba Prefecture was measured by the neutral potassium iodide method in June and July 1971. The maximun concentration was in the range of 24.6-15.5/pphm in June and 20.7-14.1/pphm in July, and the average was 4.0-5.0 pphm in June and 2.5-4.0 in July. The data were analyzed in terms of the frequency by concentration. The relationships between pollutants (oxygen, nitrogen dioxide, nitric oxide, sulfur oxides, and dust) and meteorological conditions are also discussed.

**18307** **APTIC NO. 37208**

**Kondo, Jiro**

**ANALYSIS OF POLLUTION CAUSED BY AUTOMOTIVE EXHAUST GAS.** *(Jidosha haishutsu gasu ni yoru osen jokyo no kaiseki). Text in Japanese. Preprint, Japan Society of Mechanical Engineering, Tokyo, 19p., 1971. 11 refs. (Presented at the Seminar on Environmental Pollution by Internal Combustion Engine and its Countermeasure, Tokyo, Japan, Nov. 29-30, 1971.)*

Problems of air pollution by automotive exhaust gases are discussed from the standpoint of systems engineering. APPS methods of computer programming for a traffic model, emission model, road diffusion model, local diffusion model, area diffusion model, photochemical reaction model, and flow field model are discussed and explained. Previously published material and applications to parts of Tokyo and Osaka with heavy traffic are quoted and explained with illustrations and diagrams. The future air problems pollution control plans and investment, and traffic systems and land planning are generally discussed.

**18308** **APTIC NO. 36357**

**Kumai, Motoi**

**FOG MODIFICATION STUDIES ON THE GREENLAND ICE CAP.** *Army Terrestrial Sciences Center, Hanover, N. H., Cold Regions Research and Engineering Lab., DA Task 1T061102B52A02, RR-258, 13p., March 1969. 8 refs.*

**NTIS: AD 689448**

During the summer of 1965, fog modification by propane and dry ice seeding was studied on the Greenland Ice Cap, an area with one of the lowest concentrations of atmospheric pollution on earth. The nuclei of supercooled fog droplets before seeding were observed using electron microscopy and electron diffraction methods. The nuclei of ice crystals formed by dry ice and propane seeding were also observed using the same technique. The nuclei of the supercooled fog droplets and the ice crystals formed by seeding were found to be hygroscopic sea salt particles that were easily distinguished from the clay mineral nuclei of natural snow crystals. The sublimation temperature of carbon dioxide is minus 78.5 C. The boiling point of liquid propane is minus 44.5 C at one atm pressure. Results indicate that the ice nucleation of supercooled fog by dry ice and liquid propane seeding is due to thermal effects. (Author abstract)

**18309** **APTIC NO. 36426**

**Levins, Philip L.**

**ON A CLEAR DAY.** *Ind. Res., 12(10):p. 1, Oct. 1970.*

Using the atmosphere requires recognition of the fact that there are natural sources of and sinks for pollutants, that must be understood. Carbon dioxide, for example, is a primary pollutant introduced by man. After a careful review of all known such emissions and their removal mechanisms, scientists concluded that a greenhouse effect (temperature rise caused by increased atmospheric absorption of solar energy) was imminent years ago, but to date the effect has not occurred. Increased research concerning the atmosphere and our interaction with it is needed, while it seems especially important that one form of pollution not be allowed to become transformed into another.

**18310** **APTIC NO. 36238**

**Mammarella, Luigi**

**ATMOSPHERIC STABILITY AND AEROSOL POLLUTION. (PROPOSAL OF A SIMPLE METHOD FOR EVALUATING THE CONDITIONS OF AIR STABILITY.** *Consiglio Nazionale delle Richerche, Rome (Italy), Inst. di Fisica dell Atmosfera, Rept. 36, 9p., Jan. 1971.*

Atmospheric stability is essentially a function of temperature, relative humidity, and air movements. Static thermal inversions arise from a compression of the air masses at 600-1500 meters, while radiation inversions which can form at lower levels are more important with regard to pollution. In order to evaluate atmospheric stability, the entire day may be subdivided into four quadrants: night hours, sunset or sunrise, four hours after sunrise or sunset, and noon. The quadrants are assigned coefficients of zero, one, two, and three respectively. Next, the factors deriving mainly from the hygrometic state of the air are characterized by visibility and cloudiness, also with coefficients ranging from zero to three. The hygrometric state of the ground is defined as frozen (zero), wet (one), moist (two), and dry (three). The wind can be defined with velocities less than or equal to two m/sec, one m/sec, eight m/sec, and 16 m/sec, with coefficients from zero to three, respectively. By adding up the final coefficients, the atmospheric stability conditions may be deduced: between zero and four, inversion; four to eight, neutrality; and eight to twelve, conversion.

18311 APTIC NO. 37172

Meira, Luiz Gylvan, Jr.

ROCKET MEASUREMENTS OF UPPER ATMOSPHERIC NITRIC OXIDE AND THEIR CONSEQUENCES TO THE LOWER IONOSPHERE. *J. Geophys. Res., 76(1):202-212, Jan. 1, 1971. 33 refs.*

The nitric oxide density profile in the upper atmosphere between 70 and 110 km was measured with scanning ultraviolet spectrometers aboard two Nike-Apache rockets on Feb. 6 and Jan. 31, 1969. The observed NO profile had a maximum of about 100,000,000 cu m at 105 km and a minimum of about 10,000,000, cu m at 85 km. Therefore, photochemical equilibrium is prevalent above 85 km, while dominates below that altitude. The measured NO densities are in good agreement with those computed from models attributing NO formation to excited nitrogen atoms. The model is able to explain the decrease in NO density between 105 and 85 km. The contribution of nitric oxide ionization by solar Lyman-alpha to the ionospheric total ion production is dominant in the middle D region (below 90 km). In the region above 85 km, dissociative recombination of NO ions is the main loss process; below 85 km, a faster mechanism is required.

18312 APTIC NO. 36514

Meszaros, Agnes

ON THE VARIATION OF THE SIZE DISTRIBUTION OF LARGE AND GIANT ATMOSPHERIC PARTICLES AS A FUNCTION OF THE RELATIVE HUMIDITY. *Tellus (Uppsala), 23(4-5):436-440, 1971. 13 refs.*

Atmospheric aerosol samples captured by a cascade impactor were examined under a microscope at different relative humidities to gain information on the variation of the size distribution of large and giant particles as a function of relative humidity. The results of 10 samplings, five conducted in winter and five in summer, are presented and discussed. The growth of particles with increasing humidity was more gradual in summer than in winter. In winter, changes in particle size occurred only between 86% and 98% relative humidity because of the presence of water-soluble substances. In both winter and summer samples, relative particle growth decreased with increasing particle size. The seasonal variation in particle growth may be due to the fact that more supersaturated solution droplets or acid particles are present in the summer. The connection between relative growth and particle size is explained by the increase in droplet quantity with decreasing particle radius. (Author abstract modified)

18313 APTIC NO. 36851

Mizoguchi, I., H. Nousi, Y. Sato, S. Osawa, and K. Makino

THE CORRELATION BETWEEN OXIDANTS AND VARIOUS FACTOR. *(Okishidanto to kaku inshi to no sokansei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):112, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The oxidant data obtained from May 1969 to March 1971 were analyzed with respect to the other pollutants and meteorological conditions. The occurrence and duration of high oxidant concentration (above 0.1 ppm) are increasing each year. The monthly variations in average concentration of each year showed very similar patterns. The correlation between the oxidant concentration (5-day period) and pollutant components, sulfur oxides, nitrogen dioxide, nitric oxide, and carbon monoxide, and meteorological conditions, temperature, relative humidity, and wind speed are shown in the table. Only the wind speed and CO concentration showed significant correlations. Data were divided into day and might periods, and analyzed accordingly.

18314 APTIC NO. 36291

Mizoguchi, T., T. Takamatsu, and M. Naito

MATHEMATICAL MODEL FOR PREDICTION OF CARBON MONOXIDE CONCENTRATION BY AUTOMOBILE EXHAUST GAS. *(Jidosha haishutsu gasu issanka tanso nodo no yosoku moderu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):238, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The dynamic mathematical model of carbon monoxide concentration for the periodical prediction with short intervals is discussed. Four different cases are considered according to the purpose of prediction. The diffusion of CO by the water-tank experiment, and the results of CO concentration measurement at various spot of the roads and intersections are evaluated.

18315 APTIC NO. 36495

Nakajima, Chotaro and Hideo Tagawa

PREDICTION OF AIR POLLUTION POTENTIAL IN KYOTO. *(Kyoto bonchi no taiki osen yoho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):126, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

According to the wind diagram of Kyoto basin indicating the wind speed and direction at different times of the day, relatively strong north-western wind is dominant in the afternoon while milder morning wind is mostly southernly. To investigate the effect of Osaka City on the air pollution in Kyoto, the change in sulfur dioxide concentration with time at six locations between Osaka and Kyoto city was measured during the period of Jan. 11 to 13, 1971. The SO2 concentration peak was shifted from Osaka toward Kyoto as the time of the day progressed. The geographical distribution map of SO2 concentration measured at two hour intervals indicates that the SO2 concentration is the highest in Osaka in the morning, in Yahata area in the afternoon, and in Kyoto city in the evening. However, the mode of pollutant migration is not clarified.

18316 APTIC NO. 37192

Nakamura, Kimio, H. Naito, T. Odaira, S. Fukuoka, and M. Ito

SOME STUDIES ABOUT FORECASTING OF PHOTOCHEMICAL SMOG. *(Kokagaku sumoggu yoho ni kansuru 2,3 no kosatsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):110, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The relationship between the high oxidant concentration and meteorological conditions was analyzed based on the data obtained from May 12 to June 30, 1971 in Tokyo. Of six weather patterns, the summer type with a front had the highest frequency (27%). High concentrations were reached between 11:00 and 13:00 (65%). High concentrations were accompanied by sea-land breezes. The wind speed was less than 3 m/s, and rarely above 4 m/s. No apparent relationship between temperature and high concentration was found. Visibility was greatly reduced to less than 2-3 km. At high oxidant concentrations the sulfur dioxide concentration was generally greater than at low concentrations. The duration distribution of high oxidant concentrations is shown in the diagram.

18317 APTIC NO. 36310

Nakano, M., N. Nakatsuji, K. Oda, H. Takeuchi, T. Inoue, A. Mitsuda, and K. Takeuchi

METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I). *(Osaka ni okeru taiki osen kisho chosa). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):120, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The effect of meteorological conditions on the atmospheric pollution in Osaka City which was generalyy governed by the sea-land breezes was investigated. With the increased number of high stacks (above 100 m), the wind speed at higher levels (above 300 m) should be taken into considerations. During the winter of 1971, the vertical distributions of wind direction and speed were measured by a pilot balloon and the stream lines were surveyed using a non-lift balloon. For the measurement of wind turbulence, the wind speed in the vertical and two horizontal directions were recorded. On the day of high pollutant 0concentration, a mild land-breeze blew from morning to noon. Since pollutant sources in Osaka are located in the littoral industrial area west of Osaka, pollutants should be transported to the Osaka harbor when the land breeze occurs. The high concentration in Osaka City on such days was attributable to the wind speed aloft (300 m) which was blowing from a southern or south-westerly direction contrary to the surface wind.

18318 APTIC NO. 36487

Nakazawa, M., S. Wakamatsu, Y. Saiki, S. Kanno, T. Kashimizu, K. Takamatsu, and Y. Sekiguchi

VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR. *(Taikichu jukinzoku no kodobetsu nodo bunpu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):218, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The vertical distribution of lead, cadmium, nickel, manganese, carbon monoxide, and sulfur dioxide in the polluted and nonpolluted areas in Kanagawa Prefecture were surveyed. Samples collected at different altitudes by high-volume air samplers were analyzed by the atomic absorption method. In the polluted area, the amounts of particulate matter were 76, 51, and 50 micrograms/cu m at altitudes 350, 500, and 700 m, respectively. As for heavy metals, the concentrations of Pb were 0.17, 0.14, and 0.17 micrograms/cu m at 350, 500, and 700 m, respectively. The sulfur dioxide concentration was in the range of 0.003 0.006 ppm, and decreased with the attitude. In the polluted area, the amounts of particulates were 163, 138, 144, and 107 micrograms/cu m 1.0, 31, 58, and 90 m, respectively. The heavy metal concentration was the highest on the ground level and decreased with altitude. The Pb concentration was 0.79 micrograms/cu m at 1.0 m, which decreased to 0.37 micrograms/cu m at 90 m.

18319 APTIC NO. 36436

Neal, Richard C.

DOES MAN S RELEASE OF ENERGY CONTRIBUTE TO THE MELTING OF THE POLAR ICE CAPS OR DOES IT MOVE THE EARTH TOWARD ANOTHER ICE AGE? Preprint, American Society of Mechanical Engineers, New York, 4p., 1970. 4 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, New York, Nov. 29- Dec. 3, 1970, Paper 70-WA/APC-1.)

A change of three to four F from the earth s constant average surface temperature could cause profound changes in man s physical environment, and may even lead to the disappearance of some life forms. The question only is whether atmospheric pollution shades the earth from the sun, thereby continuously lowering the earth s energy level, or whether it allows the earth continuously to absorb more of the sun s energy (greenhouse effect) and thus raise the earth s energy level. A rising energy level would cause the following: an increasing level of transport energy or an increasingly vigorous weather pattern; an increasing level of latent heat of the atmosphere, with as increasing average moisture content; and an increasing level of latent heat of the ice-water mixture causing the polar ice caps to melt. A falling energy level would cause a decreasing level of transport energy, a decreasing level of latent heat with reduced average moisture content, and a decreasing level of latent heat of the ice-water mixture causing an increase in size of the polar ice caps. Certain observations of the earth s weather pattern which might reveal whether the polar ice caps are melting or increasing due to man s release of energy are indicated. 0

18320 APTIC NO. 36307

Nomoto, H., Y. Kumazawa, T. Mizoguchi, Y. Ishikawa, and S. Maki

AN ANALYSIS OF AIR POLLUTION AND METEOROLOGICAL ELEMENTS IN OSAKA. *(Osaka no taiki osen jokyo no ichikosatsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):124, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

During the winter of 1970, high pollutant concentrations lasting for three days occurred twice. The meteorological elements during these periods were examined with respect to the pressure pattern. The altitudes of 500 mb plane of the northern hemisphere were analyzed in comparison with the weather map on the ground surface. The variation in sulfur oxides concentration, wind direction and speed, and the amount of insolation during these three days are also shown by a diagram.

18321 APTIC NO. 36522

Okamoto, Shin-ichi, Kiyoshige Shiozawa, and Atsushi Ootaki

STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (I) TIME SERIES ANALYSIS OF AIR POLLUTANT CONCENTRATION. *(Taiki osen busshitsu nodo no yosoku ni kansuru kenkyu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):243, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The relationship between the pollutant concentration at present point and that of several hours prior, which was necessary for the prediction of pollutant concentration, was evaluated by the autocorrelation analysis and the cross-correlation with meteorological factors. The correlation diagram at each season was obtained by the autocorrelation analysis of pollutants, sulfur dioxide, carbon monoxide, nitric oxide, and nitrogen dioxide, at corresponding locations. The SO2 concentration, as well as other pollutants, showed a 24 hour cycle.

18322 APTIC NO. 36501

Okita, Toshiichi, Kikuo Oikawa, and Yasumasa Ihara

OXIDATION OF SO2 BY PARTICULATES COLLECTED ON FILTERS. *(Firuta ni hoshu shita biryushi ni yoru SO2 no sanka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):247, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The effect of particulate matter on the catalytic oxidation of sulfur dioxide in the atmosphere was studied by oxidation experiments. A glass fiber filter with particulate matter collected using a high-volume air sampler at various stations in Japan was immersed in distilled water, and a gas containing 10 ppm of SO2 was passed through at the flow rate of 3.5 l/min for one hour. A definite correlation was found between the amount oxidized and the concentration of some particulate matter; the correlation coefficient for sulfate equals 0.778; vanadium, 0.747; manganese, 0.667. The correlation coefficients of cadmium, lead, zinc, iron, and copper were extremely small.

18323 APTIC NO. 36233

Onikul, R. I.

**THE APPLICATION OF COMPUTATION METHODS IN THE STUDY OF THE LAWS OF FORMATION AND FORECASTING OF RIVER FOGS.** *(Ispol zovaniye raschetnykh metodov dlya zakonomernostey obrazovaniya i prognozirovania rechnykh tumanov). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 207:121-132, 1968. 7 refs.*

A method combining theoretical studies with empirical data for forecasting various types of fog is presented. The precision of the anemoscopic indications for wind velocities above 1 m/sec is considered satisfactory. Data collected over 4 winter season periods by the Irkutsk Meteorology Observatory were used to improve the precision of the computing method. A graph deducing the daily forecast of fogs from temperature, wind, and precipitation forecasts is computed. This computing method appears to be applicable whenever the air stream is directed from the river and no precipitation is in sight. The decrease in fog iteration with increasing distances from the river confirm the applicability of the method. Such observations should be taken into consideration when the building of an airport is planned.

18324 APTIC NO. 36494

Ootaki, Atushi, Kiyoshige Shiozawa, Shuichi Furuzono, and Shinichi Okamoto

**STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (II) - BASED ON METEOROLOGICAL FACTORS.** *(Taiki osen busshitsu no yosoku ni kansuru (II) - ichinichi go no nodo yosoku no kokoromi). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):125, 1971. 4 refs. (Presented at the National Council of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The prediction of pollutant concentration is made based on the amount of pollutant released into the atmosphere, meteorological factors, and topographical factors. The prediction model based on the meteorological factors is discussed. The necessary conditions for this model are that the change in pollutant concentration is dependent on the concentration at a certain prior time, and that corrections are made with changes in meteorological factors. The statistical prediction formula which satisfies these condition is used for the prediction. The meteorological factors are relative humidity, wind direction, wind speed, visibility, atmospheric pressure, and temperature.

18325 APTIC NO. 36442

Perkins, R. W., C. W. Thomas, J. A. Young, H. G. Rieck, Jr.

**COSMOGENIC RADIONUCLIDE TRACERS OF IN-CLOUD SCAVENGING PROCESSES.** *In: Pacific Northwest Laboratory Annual Report for 1969 to the USAEC Division of Biology and Medicine. Volume II: Physical Sciences. Part 2. Radiological Sciences. Battelle Memorial Inst., Richland, Washington, Radiological Sciences Dept., p. 14-16, Feb. 1970. 3 refs.*

NTIS: BNWL-1307, Part 2

The identification of cloud processes which are instrumental in transferring and removing airborne contaminants into or from the precipitation elements requires studies of the in-cloud and total wet removal of airborne contaminants. Observations of three rainstorms in Washington with cosmogenic radionuclide measurement suggests the cloud droplets form on condensation nuclei which are labeled with cosmogenic radionuclides. During subsequent growth of the cloud droplets through coalescence and condensation, additional collection of newly formed cosmogenic radionuclides appears to be small or negligible. During their in-cloud development, the raindrops may be subjected to several cycles of partial evaporation followed by further coalescence and condensation, particularly in light rains. Light rains spend a substantially longer period in their devlopment than heavy rains. They show both higher radionuclide concentrations and higher long to short-lived radionuclide ratios. The time period for raindrop development ranged from 30-130 min in the light to medium rains. This was studied based on the Cl(39):Cl(38) ratio in rainwater relative to that of the atmosphere. Rainout coefficients were determined by comparing the radionuclide deposition per unit area at ground level to the radionuclide content per unit area of cloud in an air column of cloud thickness.

18326 APTIC NO. 36134

Petriw, Andrew

**DIRECTIONAL ION ANEMOMETER.** *Army Electronics Command, Fort Monmouth, N. J., Atmospheric Sciences Lab., Task 1TO-61102B-53A-19-20, TR-ECOM-3379, OSD-1366, 32p., Dec. 1970. 3 refs.*

NTIS, DDC: AD 720573

A directional ion anemometer capable of measuring direction angle, elevation angle, and speed of wind down to 5 cm/sec is described including sensitivity, linearity, stability, and angular response characteristic. Design and operating principles are considered. The unknown degree of ion mobility sensitivity to the variable and very low concentration constituents of the atmosphere remains the principal unknown in determining the feasibility of the proposed instrument; and an experimental model should be built in order to obtain the required data.

18327 APTIC NO. 36246

Pooler, Francis, Jr.

**ATMOSPHERIC TRANSPORT AND DISPERSION OF PESTICIDES.** *Preprint, American Chemical Society, Washington, D. C., 20p., 1971. 6 refs. (Presented at the American Chemical Society, National Meeting, 162nd, Washington, D. C., Sept. 12-17, 1971.)*

Transport and dilution of pesticides and their variations as determined by meteorological conditions are described for spatial scales ranging from the microscale, applicable to dispersion in the vicinity of a single field, on up to the global spread of airborne material. The mechanisms of removal of material from the air, principally dry deposition and precipitation scavenging, are considered. Examples of potential total surface deposition patterns, based on calculations for several meteorological conditions are shown. With sufficient knowledge of all the factors determining the exchange rate of pesticides between the components of the biosphere, and the decay rate within each component, models could be constructed to predict the future distribution of such materials, given the distribution at any arbitrary starting time. (Author abstract modified)

18328 APTIC NO. 36443

Rastorguyeva, G. P. and I. I. Solomatina.

**HEAT BALANCE STUDIES OF THE ACTIVE SURFACE IN THE AREA OF A MOLDAVIAN HYDROELECTRIC PLANT.** *(Teplovoy balans deyatel noy poverkhnosti v rayone Moldavskoy GRES.) Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 207:179-187, 1968. 3 refs.*

An analysis of heat balance data obtained from the underlying surface in the area of a Moldavian hydroelectric plant during the month of September 1965 is presented. The daily sun radiation balance, the turbulent heat flow, and the evaporation processes constituted the investigated components of heat balance. The average value (22 series of determinations) of the turbulent heat flow was P equals 100 cal/sq cm/24 hr; the heat expanditure for evaporation was V equals 87 cal/sq cm/24 hr; and the heat absorption by the ground was B equals 1 cal/sq cm/24 hr. The total P + V + B was 188 cal/sq cm/24 hr, which is considered to be rather low. The bulk of solar heat (51%) seemed to be spent on both the heating of the contiguous atmospheric layers and (44%) on the evaporation processes. The ratio between the heat balance components is a determining factor of the intensity of heat and humidity exchange occurring between the underlying surface and the higher atmospheric sheets. The vertical temperature profile, on the other hand, constitutes an important criterion indicating the condition of stability of the contiguous atmospheric sheet. The condition of stability of this atmospheric layer allows the deduction of the eventual development of turbulence within the ground layer of the atmosphere. This turbulence consitututes the main factor affecting the spreading of industrial refuse. The data presented herein could be useful in many problems of applied meteorology.

18329 APTIC NO. 36111

Raynor, Gilbert S., Eugene C. Ogden, and Janet V. Hayes

DISPERSION AND DEPOSITION OF CORN POLLEN FROM EXPERIMENTAL SOURCES. *Preprint, Brookhaven National Lab., Upton, N. Y. and New York State Museum and Science Service, Albany, 29p., 1971. 18 refs.*

Dispersion and deposition of corn pollen emitted naturally from two circular area sources 18 m. in diameter were studied in 39 tests. Concentration and deposition were measured by wind impaction samplers and greased microscope slides, respectively. Normalized centerline concentrations, crosswind integrated concentrations, plume widths and heights, normalized centerline and crosswind integrated deposition, deposition velocity, and mass flux, presented as functions of distance, are analyzed in terms of current dispersion theories and compared with similar data from ragweed and timothy sources of comparable size. Deposition between sampling circles is compared to loss in air concentration over the same distances. (Author abstract modified)

18330 APTIC NO. 36351

Risebrough, R. W., R. J. Huggett, J. J. Griffin, E. D. Goldberg

PESTICIDES: TRANSLALANTIC MOVEMENTS IN THE NORTHEAST TRADES. *Science, vol. 159:1233-1236, March 15, 1968. 13 refs.*

The transport and distribution of pesticides through the world ecosystem have been attributed to a combination of atmospheric and hydrospheric (oceanic and fluvial) currents, yet their relative contributions remain unclear. Dust samples were Soxhlet extracted for six hours with a two to one mixture of hexane and acetone; the extracts were concentrated and analyzed with a gas chromatograph equipped with electron-capture detectors. Thin- layer extracts were made of other samples. Concentrations of chlorinated hydrocarbons in airborne dust carried by the trade winds from the European-African land areas to Barbados range from less than one to 164 parts per billion. The lower limit of the average content of one cu m of air is 7.8 times 10 to the minus 14th gram. The contributions of river-borne and atmospherically transported pesticides to parts of the marine environment are calculated approximately and compared. The amounts of pesticides contributed to the tropical Atlantic by the trade winds appear to be comparable to those carried to the sea by major river systems. (Author abstract modified)

18331 APTIC NO. 36085

Rosenberg, Norman J.

AIR POLLUTION EFFECTS ON WEATHER AND CLIMATE. *Nebraska Univ., Lincoln, Extension Service; Dept. of Agriculture, Washington, D. C.; and Nebraska Univ., Lincoln, Coll. of Home Economics, Proc. Explor. Nebr. Pollut. Probl., Lincoln, Nebr., 1971. p. A-1 - A-12. 21 refs. (April 22.)*

Specific effects of aerosol and trace gas pollution on weather and climate are reviewed. Climatic fluctuations, caused by topographic and astronomic changes, changes in solar activity, variation in heat emitted by the earth, and changes in the density, composition, and turbidity of the atmosphere, are examined. Radiation balance, as the chief force of weather and climate, is discussed. Pollutant controlled mechanisms of climatic change include reflection alterations, cloud distributions and characteristics, turbidity, and precipitation augmentation or supression. Trace gas effects on climatic change involve water vapor and sulfur dioxide concentration.

18332 APTIC NO. 36434

Ross, L. W.

SIMULATION OF AIR AND WATER POLLUTION DYNAMICS: A SURVEY. *Simulation, 14(4):165-170, April 1970. 29 refs.*

Simulation of pollution is largely based on a generalized form of the diffusion equation, describing the concentration of dissolved or suspended pollutants. The case of fundamental interest in air pollution simulation is the point source in a wind. The diffusion equation assumes that convection dominates downwind transport. If the distribution of pollution from a source is Gaussian, then the standard deviation may be specified. Simulation of short-range effects in the vicinity of emission sources is complicated by thermal effects, particularly if the source is a stack, and by short-range interferences such as gustines. The Bosanquet-Pearson equation is still widely used, and is the only correlation of deposition that has found its way into state air pollution regulations. Water pollution and thermal pollution were also discussed. Simulation in wind tunnels is mentioned.

18333 APTIC NO. 36488

Sakagami, Jiro, Fusako Suzuki, and Giichi Iwata

ON THE DIFFUSION WHEN THE LAYER FLUX-ZERO IS ABOVE THE SOURCE. *(Minamoto no joku ni Flux-Zero no so no aru baai no kakusan). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):131, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The relationships among the pollutant concentration (C), the height of pollutant source (h), and the height of the flux-zero layer (H) were quantitatively examined. The concentrations were computed using Sakaguchi s equation and Sutton s equation. Defining CH infinity as the concentration in the absence of a flux-zero layer, the results were compared. According to Sakaguchi s equation, C/CH infinity are 2.5, 1.3, and 1.0 at H equals h, 1.35h, and 2h, respectively. In the case of Sutton s equation, C/CH infinity is 2.0 at H equals h and decreases similarly to the result by Sakaguchi s equation. Tables and diagrams are also included.

18334 APTIC NO. 36038

Sano, Isamu

PRODUCTION OF AEROSOLS. *(Enmutai no seisei). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 9(5):2-11, Dec. 1971. 23 refs.*

Following the classification of aerosols into smokes or mists, the fundamentals of their production are presented. Dispersion and the use of homogeneous aerosols in basic studies are reviewed. The production of lead, iron oxide, sodium sulfate, and sulfuric acid aerosols is discussed. Their particle size and distribution, density, toxicity, and chemical reactivity are considered. Aerosol generators are described, with particular reference to those which have come into recent use for producing monodisperse aerosols.

18335 APTIC NO. 36490

Sato, J., S. Sakuraba, and M. Moriguchi

DIFFUSION EXPERIMENT OVER AN URBAN AREA. *(Shotoshi no kakusan jikken). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):132, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Diffusion measurements were made in Ohmuta City in November 1970. The standard deviation of lateral gas concentration distribution plotted in Pasquill's diagram indicated that pollution in Ohmuta City was the rural type rather than the urban type. No characteristic initial spread at the point of origin was observed. The examination of the relationship between the lateral variation of wind and concentration downwind distance indicated a linear relationship within the range of 0.6 km distance and wind of less than 20 deg, while it became non-linear when wind was greater than 20 deg. No definite relationship was found between direction and average wind speed. The standard deviation of vertical gas concentration distribution was also evaluated. From the diffusion parameters of vertical and lateral concentration distribution, the ground level concentration was calculated, which decreased markedly with the increase in downwind distance.

18336 APTIC NO. 36304

Seki, K.

METEOROLOGICAL ELEMENT AND CONTAMINATIVE ELEMENT ABOUT SEASONAL APPEARANCE OF OXIDANT. *(OX hasseiji kara mita osenshitsu joken to kisho joken). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):117, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The pollutant conditions and meteorological conditions necessary for the formation of oxidant were analyzed based on yearly variation and diurnal variation in oxidant concentration and ultraviolet intensity data obtained in Tokyo. For the formation of oxidant, a suitable amount and ratio of pollutant components are necessary conditions. When the ultraviolet intensity is insufficient, the meteorological conditions which compensate the insufficiency are necessary. Topographical conditions which contribute to the formation of optimum meteorological conditions for oxidant formation, and such necessary meteorological conditions as the development of sea-land breezes and descending currents are discussed.

18337 APTIC NO. 36305

Seki, K.

METEOROLOGICAL ELEMENT AND TOPOGRAPHICAL ELEMENT ABOUT LOCAL APPEARANCE OF OXIDANT. *(OX hasseichi kara mita chikei joken to kisho joken). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):118, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The daily range of temperature at Kanto plain was prepared, which corresponded remarkably to the wind pattern in the area. A certain correlation was found between the location with a high daily range of temperature and the location with frequent occurrences of high oxidant concentration. As the case of photochemical smog in Tomakyuryo, the topographical conditions which affect the local weather condition such as the development of descending currents are important factors of photochemical smog. Aside from a suitable amount and ratio of pollutant components and high ultraviolet intensity, the local meteorological conditions suitable for the development of descending currents, situated around the meteorological pollutant source created by the sea-land breeze convection, are necessary conditions for the development of photochemical smog.

18338 APTIC NO. 36311

Seki, K.

CHARACTERISTIC OF PRESSURE PATTERN ABOUT APPEARANCE OF OXIDANT. *(OX hassei kiatsu haichi no tokucho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):119, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The pressure pattern associated with high oxidant concentration (above 15 pphm) was analyzed using pressure patterns recorded at 9:00 am and the Tokyo Weather Bureau. The pressure patterns of 60 days selected for analysis were classified into three major categories and nine patterns. At any given pressure pattern, the development of descending current is a fundamental condition for the formation of oxidant. The closed low pressure pattern accompanied by the ascending current is subsequently followed by the development of descending current. Therefore, for the prediction of high oxidant concentration occurrence, the passage of the closed low pressure should be noted aside from the pollutant conditions of the previous day.

18339 APTIC NO. 36855

Shibuya, Katsuo, Kikuo Oikawa, Yoshihito Okubo, and Mizuho Tamura

THE RELATION OF NO, NO2, AND NO3 IN THE AIR. *(Taiki-chu no NO, NO2 to NO3 tono kankei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):72, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Nitric oxide, dioxide, trioxide, and dust were measured at 15 m above the ground in Kawasaki industrial area at 2 hr intervals for four consecutive days in July, 1971; their behavior and relation to weather conditions were examined. Nitric oxide and dioxide were determined by the original Saltzman method. Nitrogen trioxide was determined by determining silver nitrate through zinc reduction. Dust was measured by a dust meter. The correlation coefficient between nitrogen dioxide and trioxide was 0.700 for 27 points. The one between nitrogen trioxide and dust was 0.791 for 27 points. The relation between nitrogen trioxide and weather conditions, such as temperature, humidity, wind direction and velocity, did not give significant results.

18340 APTIC NO. 36496

Shinra, Koichiro and Ken Matuo

THE ESTIMATION OF DIFFUSION FROM THE AREA-SOURCES. *(Mengen kara no kemuri no kakusan keisan). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):130, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The concept of consecutive linear sources was applied to the analysis of diffusion from the area source. The equations estimating the concentration distribution from the area source are derived. The concentration at a given location is expressed in terms of the amount of pollutant emitted per unit length of linear source, height of pollutant source, wind speed, distance from the source to a given location, standard deviation of concentration distribution in vertical direction, vertical diffusion coefficient by Sutton's equation, and coefficient of atmospheric stability. Taking the two sq km area as an area-source, the concentration distribution of sulfur dioxide was calculated from the amount of pollutant per year or per season emitted at three different stack heights.

18341 APTIC NO. 36039

Sutugin, A. G., N. A. Fuchs, and E. I. Kotsev

FORMATION OF CONDENSATION AEROSOLS UNDER RAPIDLY CHANGING ENVIRONMENTAL CONDITIONS. NONnCOAGULATED, HIGH-DISPERSED AEROSOLS. *Aerosol Sci., 2(3):361-368, Aug. 1971. 13 refs.*

The formation of aerosols by condensation of silver vapor contained in a turbulent jet of argon or helium entering cold air moving with a relatively low velocity was studied. Particle concentration and size distribution were measured and from these the weight concentration of the aerosol was calculated. The particle concentration was determined ultramicroscopically after enlarging the silver particles, which was performed in two steps by means of two particle size magnifiers. The particle size distribution was determined by means of the diffusion method. Considering the shortness of the condensing system lifetime before dilution, it is possible to reject coagulation as a substantial factor in the aerosol formation process. Formation of such aerosols can be explained by heterogeneous condensation on admixed nuclei if the efficiency of collision of clusters with vapor molecules and with each other depends on their size. (Author abstract modified)

18342 APTIC NO. 36282

Synoradzki, Zenon

THE EVALUATION OF CONCENTRATION PROFILES OF GASEOUS AIR POLLUTANTS IN THE GROUND LAYER, IN THE VICINITY OF A POINT SOURCE OF EMISSION. *(Obliczanie stezen gazowych zanieczyszczen powietrza w przyziemnej warstwie atmsofery). Text in Polish. Zesz. Nauk. Politech. Slaskiej, Ser. Inz. Sanit., 17(305):31-36, 1971. 2 refs.*

A method is presented enabling fast determination of the concentration of gaseous pollutants near the ground in the vicinity of a point emission source. The Sutton formula for concentration of gaseous pollutant in a ground layer emitted by a point source is converted into a function P(s) of two reduced dimensionless variables P(x) and P(y) (relative distances from the emission source measured in the direction parallel and perpendicular to wind direction, respectively). The reduced Sutton equation produces a table from which P(s) values can be read off for any value of P(x) and P(y). An example of the use of the table is given in the determination of sulfur dioxide concentration under given meteorological conditions at a certain distance from a sulfuric acid production plant. The results are presented graphically.

18343 APTIC NO. 36848

Takeuchi, Junichiro, Kazumi Koike, and Kiyotaka Mizoguchi

AIR POLLUTION DUE TO SO2 IN NAGOYA. *(Nagoya chiku ni okeru io sankabutsu nodo ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):203, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The day when 0.2 ppm or higher sulfur dioxide concentration was recorded more than six times was defined as a high pollution day. The distribution of atmospheric pressure taken at 9:00 a.m. of that day was analyzed and classified into six patterns, which indicated a certain correlation between high SO2 concentration and thy pattern. The relationship between SO2 concentration and wind direction and speed was characteristic of the area, industrial or residential. Diurnal variation in SO2 concentration and frequency distribution were also investigated.

18344 APTIC NO. 36811

Ueki, T. and Kazuo Hishida

FORECAST OF SULFUR OXIDES INTENSITY IN TOKYO. *(Tokyoto ni okeru io sankabutsu hasseigen kyodo no sanshutsu hoho ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):200, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Since the total amounts of sulfur dioxide emission during 1968 in Tokyo (estimated from the total consumption of fuel (48.5 million ton) and obtained by compiling the registered amounts by industries (13.08 million ton) showed such a big discrepancy, the method of calculating the total amount of SO2 was developed. According to the flow chart, based on the fuel consumption and the registered amount of SO2 emission, the source intensity by the administrative district, mesh, type of installation, type of industry, season, and type of fuel used, were obtained.

18345 APTIC NO. 36439

Vadot, L.

STUDY OF DIFFUSION BY MEANS OF AN HYDRAULIC ANALOGY. *(Etude de la diffusion au moyen d une analoge hydraulique). Text in French. International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 216-218. (Oct. 4-7, Paper VII/2.)*

An inverted hydraulic analogy was used to study atmospheric diffusion phenomena with density effects. The cold and warm air masses were represented by fresh and salt water, respectively. With the weight relationships reversed, the smoke plumes on the model travelled down. This investigative method was tested on problems concerning the ascent of smoke plumes due to thermals; plume behavior affected by a thermal under temperature inversion conditions; density and relief effects; and pollution in wake eddies due to buildings.

18346 APTIC NO. 36817

Velds C. A.

AIR POLLUTION FROM PLUMES, PART 5. DISPERSION CALCULATIONS. *(Luchtverontreininging uit schoorsteenpluimen, deel 5. Dispersieberekeningen). Text in Dutch. Polytech. Tijdschr., 26(23):917-925, 1971. Part 1-4, 6. Ibid., 26(18):703-709, Sept. 1, 1971; 26(19):742-747, 1971; 26(21):831-835, 1971; 26(22):878-885, 1971; 26(24):952-959, 1971.*

Concentration distributions and the geometry of plumes are explained. The calculation method of Sutton and Pasquill is described with mathematical formulae. The curves of horizontal and vertical dispersion coefficients as a function of the distance from the source are included. The variables plume height and weather conditions (stable, neutral, or unstable) are tabulated. Different assumptions made in the analysis are included, and a suitable explanation for each is presented. Other formulae in the literature are explained. Meteorological precipitation is divided into two categories: washout and rainout. For the washout category, the washout coefficient is defined. Target efficiency, coalescence efficiency, and collection efficiency are described. The influence of chemical reactions on the measured and calculated values of sulfur dioxide and nitrogen oxides is briefly explained.

18347 APTIC NO. 36819

Velds, C. A.

AIR POLLUTION FROM SMUTS, PART 2. METEOROLOGICAL ASPECTS. *(Luchtverontreiniging uit schoorsteenpluimen, Deel 2. Meteorologische aspecten). Text in Dutch. Polytech. Tijdschr., Ed. Prochestechniek (The Hague), 26(19):742-747, Sept. 15, 1971. Part I, 3-6 Ibid., 26(18):703-709, Sept. 1, 1971; 26(2):831-835, 1971; 26(22):878-885, 1971; 26(23):917-925, 1971; 26(24):952-959, 1971.*

Vertical temperature distribution wind, high and low pressure areas turbulence, and topographical influence are aspects which affect plumes. The adiabatic temperature gradient, its stability, and the daily oscillations of the stability are discussed. The influence of differences in air pressure and the rotation of the earth on the direction of wind and the wind speed are described. The influence of changes in wind speed with height is explained. The low pressure areas are indicative of bad weather in general; but from the air pollution point of view, it is advantageous to have low pressure because the slow upward movement of air distributes the pollutants over greater heights. Also, due to depression, the rain or snow washes the pollutants. The influence of standard deviation of wind fluctuation sampling time and response time on turbulence is described. Influence of the water and the location of construction and industry on air pollution are explained.

18348 APTIC NO. 36807

Wakamatsu, S., Y. Saiki, and S. Kanno

METEOROLOGICAL STUDIES ON THE AIR POLLUTION AT KEIHIN INDUSTRIAL REGION IN WINTER. *(Keihin kogyo chitai ni okeru toki no taiki osen to kisho). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):194, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The relationship between the high pollutant concentration and meteorological conditions was analyzed based on the data obtained at 12 locations in Keihin industrial region during the winter of 1970 (Dec. 1970-March 1971). The distribution of atmospheric pressure, classified into six groups, was analyzed in relation to the high pollutant concentration. The relationship between the pollution and sea-land breezes or local line of discontinuity indicated the definite effect of local line of discontinuity. Data on the temperature inversions were in good agreement with the frequency of high pollutant concentrations.

18349 APTIC NO. 36042

Wisse, J. A.

METEOROLOGICAL ASPECTS OF THE FORMING OF PHOTOCHEMICAL SMOG. *(Meteorologische aspecten van de vorming van fotochemische smog). Text in Dutch. Chem. Weekblad, 67(32):F19-F24, Aug. 6, 1971. 7 refs.*

The mixing ratio of ozone to air is maximum at a height of approximately 30 km and is 6,000 to 20,000 microgram/cu m. Below a height of 20 km, the production of ozone is very limited. The distribution of ozone is determined by the horizontal and vertical transport due to wind. Natural ozone content at ground level is not expected to be above 100 to 130 microgram/cu m. Measurements were carried out by an ozonometer. The meteorological aspects of the dispersion of air pollution are described. Meteorological aspects of the oxidation level and its effect on air pollution due to ozone formation are included. During passage of the fronts or with high winds, the ozone content varies between 40 and 100 micrograms/cu m; under low wind and cloudy skies, very low values of ozone concentration are expected. The chance of a higher oxidation level increases with increase in ambient temperature.

18350 APTIC NO. 36493

Yamamoto, H., T. Kimura, and K. Saito

ON THE TWO-DIMENSIONAL DISTRIBUTION DIAGRAMS OF WIND-VELOCITY AND AIR POLLUTION. *(Bekutoru fuhaizu oyobi osenzu no shisaku ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):128, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The two-dimensional distribution diagram of wind direction and speed was prepared by plotting the vector frequency on the polar coordinates. From the data recorded at Matsue Weather Station over a period of one month, the normalized vector frequency was plotted, by dividing data into daytime and night-time which corresponded to the active and inactive period of pollution sources, respectively. From the sulfur dioxide concentration recorded simultaneously with wind data, the two-dimensional pollution distribution diagram was prepared in a similar manner, which clearly indicated the effect of stack effluents in the vicinity.

18351 APTIC NO. 36289

Yamamoto, Mitsuhiro, Yashiro Kaneko, Hisao Ota, and Shin Kaji

RELATION BETWEEN AIR POLLUTION AND DIURNAL RANGE OF AIR TEMPERATURE IN ICHIARA DISTRICT. *(Ichihara chiku taiki osen yosatsu (I). Kiatsu haichiganta oyobi kion nichikakusa ni yoru yosatsu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):123, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The analysis of pollution mechanism at Ichihara District located in the center of Kyoba coastal industrial area was attempted. The variation in sulfur dioxide concentration with time showed a typical industrial type with one peak. Based on the data obtained from April, 1969 to March, 1970, the distribution of atmospheric pressure was classified into 14 patterns, and the frequency was indicated by the number of days. No apparent correlation was found between the high pollutant concentration and pressure pattern. The average daily range of temperature calculated by the pressure pattern for the month showed much variety in their values, however, the daily range of temperature tended to be higher on the day of high pollutant concentration.

18352 APTIC NO. 36521

Yazawa, H. and Y. Watanabe

STATISTICAL INFERENCE IN FREQUENCY DISTRIBUTION MODEL FOR AIR POLLUTION AREA. (THE 2ND). *(Chiiki osen no tokeiteki keitai ni tsuite (Dainiho)). Text in Japanese. Taiki Osen Kenkyu ( J. Japan Soc. Air Pollution), 6(1):244, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

To determine the effect of meteorological factors on the diurnal average of sulfur dioxide concentration, the SO2 concentration, wind speed, relative humidity, and temperature were recorded at four locations in Sapporo City during the winter (October to March) of 1965 to 1970. By the multivariate analysis of data, the effect of meteorological factors (variable) on the variation in SO2 concentration was determined from the contribution ratio (square of the multiple correlation between SO2 concentration and meteorological factors). The contribution ratios obtained were 20.2, 13.3, 16.9, and 32.5% at four locations, indicating a relatively small effect of meteorological factors.

18353 APTIC NO. 36520

Yoshimura, K.

CONCENTRATION OF SULFURIC ACID AEROSOL IN URBAN AREA. *(Toshi taikichu no ryusan misuto ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):206, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The relationship between the sulfuric acid aerosol concentration, meteorological factors, and regional characteristics were evaluated using data obtained from Aug. 1970 to March 1971 at two locations in Osaka. The sulfuric acid aerosol concentration was determined by the Scaringell s method, and the amount of sulfate radicals was determined by nephelometry. The H2SO4 concentration was in the range of 35.6-0.9 (average 8.3) at the center, and 35.6-1.0 (average 13.2) at the elementary school. The H2SO4 concentration tended to be higher during drizzling rain or dense fog with low wind speed.

The relationships among H2SO4 aerosol, SO4, dust, and sulfur dioxide concentrations and relative humidity are also discussed.

18354 APTIC NO. 36043

Zeedijk H.

AGAIN THE RIJNMOND. *(Nogmaals de Rijnmond.) Text in Dutch. Chem. Weekblad, vol. 67:9-11, Oct. 22, 1971.*

A period of high air pollution during September 16 to September 24, 1971 in the Rijnmond area is described and interpreted. Publicity given by the radio, TV, and other news media is described. Weather conditions, wind speeds and direction, and temperature values are included. The cases of patients reporting asthma attacks, and other lung disturbances are compared with other statistical values. The measured values of ozone concentrations in different cities in the Rijnmond area are tabulated. Complaints received at the central air pollution control center in Schiedam are recorded along with the level of air pollution. Based on this and the weather conditions, the different phases of air pollution can be described and recorded. Based on the available information, it was decided that the reason for the high air pollution during the above period was not photochemical smog, but was rather a result of sulfuric acid aerosols generated by oxidation of sulfur dioxide under humid air conditions. The continuous measurement of the aerosol of sulfur dioxide at different measuring stations is recommended.

## BASIC SCIENCE AND TECHNOLOGY

18355 APTIC NO. 36371

Cartwright, J.

PARTICLE SHAPE FACTORS. *Ann. Occupational Hyg., vol. 5:163-171, 1962. 11 refs.*

Shape factors of irregularly shaped particles were compared with the corresponding shape factors calculated over a range of axial ratios of a spheroidal model. The results show that the volume and surface shape factors and the settling speeds of coal and quartz particles below 10-micron diameter correspond reasonably well to those of an oblate spheriod with an axial ratio of two to five to one. The effects of changes in orientation are in agreement with the results of light scattering experiments calculated for this model on particle suspensions but could not be confirmed by experiment with alide-mounted particles. This may be due to experimental difficulties in controlling the orientation of particles: changes due to orientation as calculated from the model would be sufficient to cause a substantial change in the volume shape factors of particles. The spheroidal model does not simulate the distribution of the shape factor of irregularly shaped particles, but it is possible that variants of the model may partly achieve this.

18356 APTIC NO. 36103

Chow, Tsaihwa J. and C. C. Patterson

THE OCCURRENCE AND SIGNIFICANCE OF LEAD ISOTOPES IN PELAGIC SEDIMENTS. *Geochim. Cosmochim. Acta, vol. 26:263-308, 1962. 85 refs.*

Leads representing a major portion of the continental surface of the earth were sampled in pelagic sediments and isotopically analyzed. About two-thirds of the lead in all Pleistocene pelagic sediments has been chemically precipitated from lead dissolved in seawater; the remaining one-third has been transported as a constituent of solid particles. Dissolved lead in the oceans originates from the chemical denudation of continents; different drainage regions contribute leads of different isotopic composition. The travel time of chemically precipitated lead is short compared to the mixing time of different large water masses, so lead of uniform isotopic composition is not simultaneously depostied everywhere on ocean floors. This phenomenon prevents the use of lead as a chronometric index in lead-rich, uranium-poor marine sediments for intervals shorter than 100 million years. The present rate of soluble lead denudation, free of industrial contamination, is seven times greater than the average rate of chemical precipitation for the Pleistocene. Lead is transported from continents to pelagic regions in disproportionately greater amounts than uranium and thorium, complicating the isotopic evaluation of lead in continental surface materials, and lead denuded from some regions of extensively reworked sediments contains abnormally large proportions of Pb(206). Several causes of the isotopic variations of leads denuded from continental surfaces are postulated, mean isotopic composition of lead in the continental crust. The effect of industrial contamination is unknown, but it could conceivably contribute dissolved lead to the oceans at a rate much greater than the average of the last million years; much of the lead now in young ocean waters may be seriously contaminated by ore lead mined by man. (Author abstract modified)

18357 APTIC NO. 36219

Collina, A., M. Cucchetto, F. Traina, A. Cappelli, and M. Dente

KINETICS OF SULFUR DIOXIDE OXIDATION WITH MONTECATINI EDISON CATALYST AND MATHEMATICAL MODEL OF AN INDUSTRIAL REACTOR. *Preprint, American Institute of Chemical Engineers, New York, 14p., 1970. 3 refs. (Presented at the American Institute of Chemical Engineers, Annual Meeting, 63rd, Chicago, Ill., Nov. 29-Dec. 3, 1970.)*

A mathematical model for simulating multi-layer industrial reactors for sulfur dioxide oxidation is described. The model is based on a kinetic equation determined for the Montecatini Edison catalyst and takes into account the physical phenomena involved in the evolution of the chemical reaction (mass and heat transfer between the gas phase and catalyst, diffusion of the reagents and products in the porous catalyst. The model has been used for simulating performances and for simulation of industrial reactors operating at a pressure greater than one atmosphere. (Author introduction modified)

18358 APTIC NO. 36077

Corriveau, C. and R. L. Pigford

RATE OF REACTION OF GASEOUS NITROGEN OXIDES WITH WATER. *In: Nuclear Chemistry Annual Report 1970. California Univ., Berkeley, Lawrence Radiation Lab., Atomic Energy Commission Contract W-7405-eng-48, May 1971, p. 265.*

NTIS: UCRL-20426

Knowledge of the solubility of gaseous nitrogen oxides in water and rate coefficients is needed not only for chemical processes involving nitrous gases but also for removal of the compounds from power plant flue gases. Rate measurements were obtained for the solution of nitrogen dioxide from gaseous mixtures with nitrogen into a stream of water flow over a spherical surface. The measurements show that the rate of solution and reaction is proportional to pN204. This indicates that NO2 molecules first react in the gas to form the dimer, N204, which dissolves and reacts with water by a bimolecular process. Values were also obtained for the Henry s Law coefficient for unreacted N204 in water and for the pseudo first-order reaction rate constant in the bimolecular process. The results show that the solubility is about twice that of carbon monoxide, and that the half-life of a molecule after it dissolves is about 0.01 sec at room temperature.

18359 APTIC NO. 36524

Domrachev, G. A., K. G. Shalnova, and V. A. Varyukhin

CATALYTIC REDUCTION OF TERTRAPHENYL LEAD WITH BIS-ALLYL PALLADIUM CHLORIDE.

*(Kataliticheskoye vosstanovleniye tetrafenilsvintsa v reaktsii s bis-allilpalladiykhloridom). Text in Russian. Zh. Obshch. Khim., 41(9):1924-1925. 1971. 2 refs.*

The reaction of tetraphenyl lead with bis-allyl palladium chloride was studied. It is a substitution reaction, which is catalyzed by Lewis-type acids (allyl palladium chloride in this case). The mechanism of the reaction is discussed. Most probably, the reaction of tetraphenyl lead with bis-allyl palladium chloride takes place in a complex and results in the dealkylation of tetraphenyl lead and the catalytic reduction of Pb(IV) to Pb(II). In the analysis of the reaction products, the following substances were found: benzene, diphenyl, allyl benzene, tetraphenyl lead, diallyl, and lead(II) chloride.

18360 APTIC NO. 36137

Fricke, L. B., P. T. Wooler, and H. Ziegler

A WIND TUNNEL INVESTIGATION OF JETS EXHAUSTING INTO A CROSSFLOW. VOLUME IV. ADDITIONAL DATA FOR THE THREE-JET CONFIGURATION. *Northrop Corp., Hawthorne, Calif., Aircraft Div., Air Force Contract F33615-69-C-1602, Proj. 698BT, AFFDL-TR-70-154, 191p., Dec. 1970.*

NTIS, DDC: AD 718123

A low speed wind tunnel test of a four-foot diameter circular plate model with up to three exhausting jets was conducted to determine surface static pressure distributions, jet paths, and jet decay characteristics in the presence of a crossflow. Data were obtained for the one-jet configuration with the jet exiting at a number of angles to the plate and at various ratios and sideslip angles. Two-jet arrangements were tested with the jets exiting normal to the plate for three different spacings between the two jets and at a number of velocity ratios and sideslip angles. Three-jet configuration data were obtained with the jets exiting normal to the plate for a number of velocity ratios and sideslip angles. As a result of this investigation, several conclusions are deduced pertaining to the interaction of multiple jets exhausting into a crossflow. The present volume contains additional information on surface pressure coefficients pertaining to the three-jet configuration. (Author abstract modified)

18361 APTIC NO. 36036

Govers, T. R. and J. Schopman

TRANSLATIONAL SPECTROSCOPY OF THE UNIMOLECULAR DISSOCIATION NO+ YIELDS 0+ PLUS N. *Chem. Phys. Letters (Amsterdam), 12(2):414-418, Dec. 15, 1971. 19 refs.*

An analysis is made of the momentum distribution of forward- and backward scattered positively charged oxygen ion fragments, produced in the dissociation of positively charged nitric oxide ions from a 10 keV ion beam at residual gas pressure. The structure observed is ascribed to the unimolecular predissociation of a number of vibrational levels of at least two electronically excited states on NO+. The results are complementary to recent high-resolution photo-electronic and mass-spectrometric studies of this ion. Apparatus comprised a unoplasmatron ion source, an accelerating and focusing system, an 187 cm-long drift region in which a collision chamber was placed, and an 180 deg inhomogeneous analyzing magnet. (Author abstract modified)

18362 APTIC NO. 36100

Henein, N. A.

A MATHEMATICAL MODEL FOR THE MASS TRANSFER AND COMBUSTIBLE MIXTURE FORMATION AROUND FUEL DROPLETS. *Preprint, Society of Automotive Engineers, Inc., New York, 7p., 1971. 14 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710221.)*

The vapor diffusion and the combustible mixture formation around evaporating fuel droplets were studied. A model to predict the ignition delay for the droplet is presented which assumes that the droplet is suddenly brought into contact with a high temperature oxidizing atmosphere. The formulas derived for droplet temperature and vapor concentration profiles take into consideration the unsteady period before the droplet reaches equilibrium temperature. The ignition delay is considered equal to the period of time from the start of heating up to the time of formation of a stoichiometric mixture at the ignition location around the droplet. Temperature and concentration history and ignition delay are computed for iso-octane droplets evaporating in air. Droplet sizes considered are between 1120 and 1520 micron. (Author abstract modified)

18363 APTIC NO. 36107

Hodgeson, J. A., R. K. Stevens, and B. E. Martin

A STABLE OZONE SOURCE APPLICABLE AS A SECONDARY STANDARD FOR CALIBRATION OF ATMOSPHERIC MONITORS. *Preprint, Instrument Society of America, Pittsburgh, Pa. 19p., 1971. 12 refs. (Presented at the Instrument Society of America, Analysis Instrumentation Symposium, Houston, Tex., April 1971.)*

A stable ozone source for the calibration of atmospheric ozone-oxidant analyzers, currently being evaluated at the National Bureau of Standards as a secondary ozone calibration source, is described. The total system comprises a diaphragm pump, air clean-up train, low pressure flow regulator, flowmeter, ozone source, and sample manifold. The ozone source consists of a current-controlled, low pressure mercury arc lamp which irradiates a quartz tube through which the air flows. Flow is maintained constant at 10 l/min and variable ozone levels, 0-1ppm, are obtained by variable shielding of the lamp envelope. Data are given on the effects of variation of flow and line voltage on the ozone output and on short-term ripple in ozone output and long-term stability. Results are included from a three-month field evaluation of ozone-oxidant analyzers in downtown Los Angeles. These data suggest that the ozone source, once initially calibrated, provides more reliable routine calibration than manual iodometric analyses. The potential application of the source in the calibration of nitric oxide and nitrogen dioxide monitors is also discussed. (Author abstract modified)

18364 APTIC NO. 36294

Homma, K.

THE GENERATORS AND GENERATING METHODS OF THE STANDARD AEROSOLS. *(Hyojun ryushi no hasseiho). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 9(5):28-40, Dec. 1971. 16 refs.*

Various methods of generating standard aerosols for testing high performance air filters are discussed. The power dispersion methods include simple dispersion of powder in the air current, blowing of compressed air into the powder containing vessel, and suction of powder by an ejector and simultaneous dispersion of it in the air. The rotation type drum feeder creates an even distribution of particles for an extended time. The method of generating particles by scattering liquid include the jet spray of liquid by compressed air and the use of spinning atomizers which spray liquid by the centrifugal action of a rotating disc. As one example of the combustion method of creating aerosol particles, an experiment was conducted using a pesticide fumigator. Approximately four grams of a cylindrical fumigator were divided into sections of various weights, and the quantity of produced particles was examined by a digital dust counter in a 27 cu m chamber. The particles tended to coagulate and precipitate because of the static electricity and the high concentration created in the chamber, and the concentration decreased 50% in 90 min after the combustion. However, the suspended particle sizes during this time were relatively stable. Creation of vapor and condensation by heating solid or liquid material is another method. The well-known Sinclair-LaMer Method and the high frequency heating fume method are exmained.

18365 APTIC NO. 36328

Junge, C. E.

COMMENTS ON CONCENTRATION AND SIZE DISTRIBUTION MEASUREMENTS OF ATMOSPHERIC AEROSOLS AND A TEST OF THE THEORY OF SELF-PRESERVING SIZE DISTRIBUTION. *J. Atmospheric Sci., 26(3):603-608, May 1969. 11 refs.*

The difficulties in applying the theory of self preserving size distributions to atmospheric aerosols was discussed. Typical features of atmospheric aerosol distributions were mathematically described. The major portion of the aerosol volume is between 0.1 and 100 micron. Neither self-preserving distribution nor quasi-stationary distribution can provide an explanation for the observed regularities of the aerosol distribution for a radius greater than 0.1 micron. An explanation was suggested based on the observation that for average conditions in continental surface air, the resulting log-volume distribution is approximately constant.

18366 APTIC NO. 37167

Lorenzi, Antonio

CHARACTERISTICS OF POROUS WALLS FOR MEASURING LOW GAS FLOW-RATES. *(Caratteristiche di setti porosi per la misura di piccole portate di gas). Text in Italian. Termotecnica (Milan), 25(5):265-271, 1971. 22 refs. (Presented at the Congresso Nazionale ATI, 25th, Trieste, Italy, Sept. 1970.)*

The characteristics of metal porous walls with suitable diaphragms, used to measure low gas flow rates was studied. The linearity range of the wall response curves was determined as a function of some characteristics. The linearity range appeared to be increased by wall diameter and was practically independent of the wall filtration threshold.

18367 APTIC NO. 36322

Los, J. and J. Kistemaker

ON THE INFLUENCE OF TEMPERATURE DISTRIBUTIONS INSIDE A GAS CENTRIFUGE. *Proc. Intern. Symp. on Isotope Separation, Amsterdam, Netherlands, 1957, p. 695-700. 3 refs. (April 23-27.)*

A theoretical treatment is given of the flow pattern required for optimal isotope separative power in a countercurrent centrifuge. In addition, the separative power is calculated for a Groth centrifuge, where the countercurrent is established by thermal convection. In this type of centrifuge, one lid is kept at a slightly elevated temperature, the other at a somewhat lower temperature. The calculations, which assume that the flow pattern is represented by the Martin relation, yield a separative power in good agreement with the optimal separative power for the same centrifuge. The theoretical results agree very well with experimental values.

18368 APTIC NO. 36223

Makishima, Shin-Ichi, Susumu Ohkata, and Takashi Shirai

DISCHARGE RATE OF SOLID PARTICLES THROUGH ORIFICE WITH COCURRENT STREAM OF GAS. *J. Chem. Eng. Japan, 3(1):112-116, Jan. 1970. 12 refs. (Presented at the Society of Chemical Engineering, Annual Meeting, 34th, Japan, April 1969.)*

A general equation for estimating the discharge rate of solids through an orifice is developed for three cases: (1) when the solids flow out only by gravity, (2) when they flow concurrently with a gas stream, and (3) with fluidized beds. The equation, derived theoretically from those of Janssen and Ergun and experimentally proven, predicts the discharge rate of solid particles through differently shaped orifices when accompanied by a concurrent stream of gas. The effect of gas velocity is diagrammed and the procedures for the design calculation are shown.

18369 APTIC NO. 37213

Matsuura, Akira and Sadao Oomichi

VARIATION OF CONCENTRATION BETWEEN SULFUR DIOXIDE AND PARTICLES. *(Nisanka io nodo no biryushi ni yoru henka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):58, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

For the purpose of investigating the effect of other pollutants in the atmosphere such as particulate metals on sulfur dioxide behavior, the effect of lead particles on SO2 concentration was measured. The experimental apparatus is described with a schematic diagram. The SO2 from a permeation tube and Pb particles from an electric furnace were led into a test chamber were both components were throughly mixed. The SO2 concentration was then determined by the West-Gaeke method. By the presence of various amount of Pb particles, the SO2 concentration was reduced to 66-48% of the original concentration.

18370 APTIC NO. 36076

McCabe, L. J.

METAL LEVELS FOUND IN DISTRIBUTION SAMPLES. *Preprint, American Water Works Assoc., New York, 9p., 1970. (Presented at the American Water Works Association Seminar on Corrosion by Soft Water Washington, D. C., June 21, 1970.)*

Some trace metals are included in the Drinking Water Standard because they are toxic and the limit is set to protect the public health: cadmium, chromium, lead, and silver, for example. Others are toxic at high levels but the limits are set to keep the water potable, e.g., copper and zinc. Other metal limits are based on aesthetics, as with iron and manganese. However, analysis of distribution samples from public water supply systems, carried out as part of the Public Health Service Community Water Supply Study, indicates that some families are receiving too much lead as well as some other compounds in their drinking water. Water with relatively lower pH showed the most samples exceeding the standards, while the metal problem was greater with the least mineralized water.

18371 APTIC NO. 36067

Nix, J. and Tom Goodwin

THE SIMULTANEOUS EXTRACTION OF IRON, MANGANESE, COPPER, COBALT, NICKEL, CHROMIUM, LEAD, AND ZINC FROM NATURAL WATER FOR DETERMINATION BY ATOMIC ABSORPTION SPECTROSCOPY. *At. Absorption Newslett., 9(6):119-122, Nov.-Dec. 1970. 8 refs.*

A method for the determination of eight heavy metals (iron, manganese, copper, cobalt, nickel, chromium, lead, and zinc) in natural water in the concentration range of a few ppb is presented. The method utilizes a diethyldithiocarbamic acid chelation followed by a methyl isobutyl ketone extraction to preconcentrate all eight of the metals in a single extract. This extract can be used for the determination of the metals by atomic absorption spectroscopy. Using proper field filtration, the method can be adapted for the determination of both the filtered and particulate fraction of these metals in natural water. (Author abstract)

18372 APTIC NO. 36319

Ouwerkerk, C. and J. Los

THE SEPARATIVE POWER OF SHORT COUNTERCURRENT CENTRIFUGES. *United Nations, New York, Proc. U.N. Intern. Conf. Peaceful Uses At. Energy, 3rd, Geneva, 1964, vol. 12:367-371. 6 refs. (Aug. 31-Sept. 9.)*

Cohn's column equations are employed to describe the behavior of short countercurrent centrifuges. These include the centrifuges of Goth and Zippe in which the feed is introduced through a tube that is placed in the axis of a rotating drum and which does not necessarily rotate. In this way, most of the feed will be introduced in the forward flow, thus giving rise to an asymmetry in the column parameters between the rectifying and the stripping part. It was recently noted that these centrifuges have an isotope separative power that amounts to 80% of the theoretical maximum separative power. The present study shows that the asymmetry in column parameters can cause a further 15% reduction in the separative power.

18373 APTIC NO. 36537

Reist, Parker C. and William C. Hinds

OPTICAL PROPERTIES OF SODIUM AEROSOLS. *(Optische Eigenschaften von Natrium-Aerosolen). Text in German. Staub, Reinhaltung Luft, 31(8):326-331, Aug. 1971. 10 refs.*

In the present search for new methods of power generation, attention is being given to sodium cooled liquid metal fast breeder reactors. One potential hazard with this type of reactor results from the large quantities of metallic sodium which must be circulated as a coolant and which, could, on burning, produce a highly radioactive and optically dense cloud. Measurements of the optical properties of this cloud are discussed as well as angular light scattering properties of the cloud particles. At high aerosol concentration, multiple scattering was evident. At concentrations above 1 g/cu m, vision would be restricted to 4 m or less. In all cases, strong forward scattering was evident. At low concentrations, transmission measurements were used to deduce the apparent aserosol particle specific gravity, which was found to be 1.2. Scanning electron microscope photographs appear to confirm this conclusion.

18374 APTIC NO. 36323

Skubenich, V. V.

EXCITATION CROSS-SECTIONS OF CARBON MONOXIDE LEVELS WITH ELECTRON COLLISIONS. *(Secheniya vozbuzhdeniya urovney okisi ugleroda stolknoveniyami elektronov). Text in Russian. Opt. i Spektroskopiya, 23(6):990-991, Dec. 1967. 7 refs.*

The excitation cross-sections of carbon monoxide were somewhat smaller than for nitrogen. Energy--cross section plots for singlet and triplet states are presented. These were derived from measurements of absolute excitation functions for ten CO molecular band systems, and three CO(+) molecular ion systems.

18375 APTIC NO. 36157

Soo, S. L.

SEDIMENTARY PIPE FLOW. *Preprint, 22p., 1971. 21 refs. (Presented at the International Symposium on Two-Phase Systems, Haifa, Israel, Sept. 1, 1971, Paper 4-9.)*

The effect of sedimentation on the fully developed flow of a suspension of particles in gravitational and electric fields is analyzed. Additional considerations are diffusion and settling under field forces, the sticking probability of a particle at the wall, and the sticking probability to a bed of similar particles. The transient condition gives the rate of buildup of a bed of deposited particles. Conditions of fully developed flow, including a moving bed sliding along with the fluid particle suspension and pulsating flow, are discussed. The method is applicable to pipes at any inclination to the direction of gravity. (Author abstract modified)

18376 APTIC NO. 36177

Soo, Shao L.

CORE VELOCITY DISTRIBUTION IN SWIRLING PIPE FLOW. *Z. Angew. Math. Phys., vol. 21:125-129, 1970. 7 refs.*

The steady state of the core of a viscous fluid in vortex motion in a pipe can be described by the Burgers line vortex, provided that the axial flow component and the direction of the decreasing pressure coincide. The range of solid-body rotation increases with decrease in pressure drop. The core becomes stationary when a sufficient pressure drop occurs opposite to direction of the flow. Knowledge of steady conditions is useful in estimating performance of industrial cyclones. (Author abstract modified)

18377 APTIC NO. 36402

Steer, R. P., J. L. Sprung, and J. N. Pitts, Jr.

SINGLET OXYGEN IN THE ENVIRONMENTAL SCIENCES. EVIDENCE FOR THE PRODUCTION OF 02 (1 DELTA G) BY ENERGY TRANSFER IN THE GAS PHASE. *Environ. Sci. Technol., 3(10):946-947, Oct. 1969. 14 refs.*

Evidence for the production of singlet oxygen (02 (1 delta g)) by energy transfer to oxygen from the first excited triplet states of benzene and naphthalene in the gas phase was obtained. Emission from 02 (1 delta g) at 1.27 micron in illuminated oxygen-napthalene mixtures and the production of 2,3-dimethyl-2-hydroperoxy-1-butene in irradiated benzene-oxygen-tetratmethyl-ethylene mixtures were observed. These studies may be of considerable importance in understanding the chemistry of polluted urban atmosphere. First, because of the relatively high concentrations of aldehydes, ketones, and aromatic hydrocarbons present in polluted urban atmospheres and because of the large extinction coefficients of many of these compounds in the near ultraviolet region of the spectrum, there exists a good potential source of triplet sensitizers which may produce singlet oxygen. Second, the presence in urban atmospheres of high concentrations of pollutants (such as olefins) which may be rapidly oxidized by singlet oxygen suggests that single oxygen may possibly play an important role as an oxidant in photochemical air pollution.

18378 APTIC NO. 36320

Sutugin, A. G.

COAGULATION CONSTANTS OF AEROSOLS AT KNUDSEN NUMBERS OF THE ORDER OF 1.0. *Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 29(6):633-634, Nov.-Dec. 1967. 5 refs.*

A flow method was used to determine the coagulation constant of uncharged dioctyl sebacate aerosol with an average particle radius of 100 A (Knudsen aerosol number approximately 2). The average value of the constant was 13.4-10 to the minus 10th power cu cm/sec This result is in satisfactory agreement with the Fuks equation for the coagulation constant in the intermediate range. The role of molecular forces in coagulation of dioctyl sebacate aerosol with an average particle radius of 100 A is not large. (Author conclusions)

18379 APTIC NO. 36086

Undintseva, V. S. and G. I. Chufarov

KINETICS OF THE REACTION BETWEEN SO2 AND H2S. *Khim. Prom. (Moscow), 17(3):24-28, 1940. 5 refs. Translated from Russian. Central Electricity Generating Board, London (England), Information Service, 12p.*

The kinetics of the reaction between sulfur dioxide and hydrogen sulfide within the range 250-350 C, occurring in the contact apparatus of sulfuric acid plants and the effect of reaction vessel surface and type of wall surface on the reaction rate were studied. The reaction proceeds exclusively on the walls of the reaction vessel. Within the pressure and temperature range studied, the reaction rate in a glass vessel is directly proportional to the sum of the partial pressures of an equivalent mixture of the reagent gases. The ratio of the quantities of H2S and SO2, reacted in a unit of time and was equal to the ratio of the surfaces of the vessels in vessels of different dimensions. The reaction was sensitive to the state of the reaction vessel surface and the reaction rate varied widely in response to changes in the state of the surface. The covering of the surface of the glass reaction vessel with metal films of iron, copper, and aluminum and the exposure of films of these materials to H2S and SO2 mixtures, showed that in all cases the reaction is retarded by comparison with glass surfaces. However, with a film containing aluminum, the reaction proceeds more rapidly than with all the other films and approximates the rate on a pure glass surface.

18380 APTIC NO. 36325

Wasserman, Harry H. and John R. Scheffer

SINGLET OXYGEN REACTIONS FROM PHOTOPEROXIDES. *J. Am. Chem. Soc., vol. 89:3073-3075, 1967. 17 refs.*

The use of 9,10-diphenylanthracene to bring about typical singlet oxygen reactions when it is allowed to decompose in the presence of a variety of known singlet oxygen acceptors was described. The reaction was carried out by heating a mixture of the peroxide and the acceptor in benzene or chloroform for two to four days. The products isolated were identical with those formed in parallel dye-photosensitized autoxidation reactions and were characterized by comparison with authentic samples.

18381 APTIC NO. 36914

Yalamov, Y. I., B. V. Derjaguin, and V. S. Galoian

THEORY OF THERMOPHORESIS OF VOLATILE AEROSOL PARTICLES AND DROPLETS OF SOLUTIONS. *J. Colloid Interface Sci., 37(4):793-800, Dec. 1971. 11 refs.*

In order to solve completely the problem of capturing aerosol particles from gas currents and the theory of thermophoresis, it is necessary also to develop a theory for volatile aerosol particles and volatile droplets of solutions. Hydrodynamic slip theory is applied to a moderately large spherical volatile aerosol particle having the radius R and suspended in a binary gas mixture. The velocity of particle thermophoresis is given, as well as equations which describe the stationary diffusion of the first component of the gas mixture, stationary heat conductivity, and temperature distribution. Volatile droplets are formed predominantly on dry condensate nuclei with subsequent transformation into drops of solution. Therefore, according to Raoult s law, the pressure of the saturated vapor of the volatile substance reduces at the surface of the solution droplet compared with the pressure over a pure single component drop. This, in turn, changes the concentration jump in the Knudsen layer over the drop surface. As a result, there appears the dependence of the thermophoretic velocity on the concentration of the solute. Boundary conditions are given for a moderately large spherical droplet of aerosol having low relative content of the substance dissolved in it, assuming that volatility of a particle is only due to the solvent.

18382 APTIC NO. 36835

Yamate, N.

STUDIES ON PHOTOCHEMICAL PRODUCTS OF AROMATIC HYDROCARBON-NITROGEN DIOXIDE MIXTURES IN AIR. *(Hokozoku tanka suiso to nisanka chisso kongo gasu no kokagaku seiseibutsu ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):51, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Photochemical products of mixtures of aromatic hydrocarbons, such as benzene, toluene, and m-xylene, and nitrogen dioxide, produced by applying xenon light, were analyzed by means of infrared spectrophotometry, gas chromatography, colorimetry, and gas chromatographic mass analysis. The reduction of concentrations of hydrocarbons, upon application of the light from the original values (1000 ppm of each hydrocarbon and 300 ppm of nitrogen dioxide) were larger for the mixtures than for hydrocarbons alone. A couple of ppm of formaldehyde were formed for each mixture after 4 hr of light application. Methyl nitrate was produced from the toluene mixture and methyl nitrite, methyl nitrate and biacetyl were formed from m-xylene mixture.

## EFFECTS-HUMAN HEALTH

18383 APTIC NO. 36812

Council for the Living Environment (Japan), Div. of Public Nuisance

DETERMINATION OF AIR POLLUTION BY PARTICULATE SUBSTANCES AND THEIR EFFECT ON MAN. *(Fuyu-ryushijo busshitsu ni yoru taiki osen no sokutei to hito eno eikyo). Text in Japanese. 106p., June 1971. 122 refs.*

Environmental contamination by particulate substances was studied including the condition of air pollution by particulates, their effects, and their measurement methods. The particulate substances studied were less than 10 micron in diameter. Principal reports of studies on particulate substances, the concentration of particulate substances, the effects of co-existing substances, and environmental standards in foreign countries, were studied based on the literature. The concentration of particulate substances should always be determined under the conditions: the average value for 1 hr in 24 hr is below 100 micrograms/cu m; and the value for any 1 hr is below 200 micrograms/cu m. These conditions should be regularly checked and amended according to the result. The effects of sulfur dioxide are also discussed.

18384 APTIC NO. 36829

Japan Society of Public Health and Committee for Investigation of Diseases Caused by Air Pollution (Japan)

CASE REPORTS OF THE DIAGNOSIS RELATED TO AIR POLLUTION. *(Taikiosen ni kakawaru shitsubyo no shindan ni kansuru jirei kenkyu hokoku sho). Text in Japanese. 58p., March 1971.*

The actual conditions of the patients with diseases related to air pollution in Kawasaki, Yokkaichi, Osaka, and Amagasaki were compared to obtain proper and effective measures for the relief of patients. The method of recognition of infant and child patients, treatment of secondary symptoms, and documents concerning recognition were investigated as a common problem. The lung function test was too much difficult a test for infants and children. Reference to anamnesis by interviews and opinions of consulting physicians were important as an adequate substitution. To make a clear relationship between objective diseases such as chronic bronchitis, bronchial asthma, asthmatic bronchitis, and pulmonary emphysema and individual diseases was more reasonable than to list a single disease. Though the number of applicants and those approved were reported monthly, it was desirable to present more detailed reports. The studies on the follow-up of recognized patients and a calculating method of the residence period when a patient was transferred to another district or tentatively moved to neighboring district were necessary. Studies on eye, ear, nose, and larynx in relation to secondary symptoms, medical care security, and investigations from the public health point of view were also needed. The treatment for acute diseases is hard to obtain by present measures.

18385 APTIC NO. 36873

Toyama Prefecture (Japan)

REPORT ON HEALTH SURVEY OF FUKUOKA-CHO CITIZENS. *(Fukuoka-cho jumin kenko chosa hokoku (Kankyo hoken shiryo 5)). Text in Japanese. 50p., Sept. 1971. 3 refs.*

A health survey of citizens of Fukuoka-cho in Toyama Prefecture, where a refinery is located, was conducted. The 408 inhabitants who lived within 500 m of the refinery were studied. The highest value of floating dust in the air around the refinery was 0.153 mg and the lowest was 0.023. In the first health survey, held on Nov. 30, 1970, questionnaires concerning self-conscious symptoms, general medical examinations, and urine tests were conducted. The average rate of complaining was 11.2%. When classified according to age, those who were 15-29 years old showed the highest complaint rate and those over 60 years old had a lower than average rate, which was surprising. The self-conscious symptoms were sputum (30.0%), coughs, labored respiration, lumbago, sore throat, headache, and pains on legs and hands. When the complaint rate was classified by sex, stuffed nose was significantly higher in men and pains in legs and hands was higher in women. The result of the first survey was compared with that of a health survey of the inhabitants of the Oshima and Daimon areas. Secondly, 74 persons studied in the first survey were also examined orally, physically, and by a urine test, X-ray examination, and functional test of the lung. The third examinations were carried out on five persons who showed lower lung function. When the number of patients who visited doctors with national health insurance in the surveyed area and control area were compared, the rate of the patients in the surveyed area was high, with significant difference in respiratory diseases, eye troubles, and skin diseases. Sickness directly caused by air pollution was not observed.

18386 APTIC NO. 36255

Amdur, Mary O.

THE IMPACT OF AIR POLLUTANTS ON PHYSIOLOGIC RESPONSES OF THE RESPIRATORY TRACT. *Proc. Am. Phil. Soc., 114(1):3-8, Feb. 1970. 12 refs. (Presented at the Symposium on Atmospheric Pollution: Its Long-term Implications, April 25, 1969.)*

Evidence from experimental toxicology indicates that sulfur dioxide itself is a mild respiratory irritant. One basic physiological response to inhalation of SO2 and related irritants is bronchoconstriction. Data indicate the importance of particulate irritants and strongly suggest that further information is needed on what irritant particles are present in the atmosphere and their size distribution. Whether sulfuric acid and irritant sulfates are present as primary pollutants or whether they are formed by chemical reaction in the atmosphere, it appears that such particles, compared on the basis of sulfur equivalent, have a far greater irritant potency than does SO2 gas. The implication is that the proper way to assess the importance of SO2 as an air pollutant is in terms 0of its potential to form irritant particles and not solely in terms of its irritant potency in the gaseous state. There is increasing evidence from the field of atmospheric chemistry that such conversion does occur, especially under conditions of fog and high humidity. To place major emphasis on the relatively innocuous character of the observed response to pure gaseous SO2, and to present this as evidence against the need for control measures misses the critical toxicological point.

18387 APTIC NO. 36446

Astolfi, Emilio

REALITY OF THE TOXICOLOGICAL PROBLEM IN INFANCY. *(Realidad del problema toxicologico in la infancia). Text in Spanish. Semana Med. (Buenos Aires), 123(42):1670-1673, 1678, 1963.*

A review of the literature reveals that children may be poisoned not only by accidental ingestion of various toxic substances found around the house but also by food, food preservatives and various pollutants found in the air. Among the latter, high levels of carbon monoxide in the air are produced by internal combustion engines, coal burning stoves, and gas used for domestic heating and cooking. In children, the chronic effects of CO are manifested through asthenia, anorexia, headache, slight anemia and behavior disorders. The presence of lead in the air may also induce toxicity phenomena in children. Brief mention is made of a child hospitalized with hypertensive encephalopathy; the child was living in an area where many people were affected by the high lead levels emitted from a nearby factory (actually, toxicological examination of a case of spontaneous abortion revealed a high amount of lead in the placenta). 0

18388 APTIC NO. 36517

Babushkina, L. G., N. P. Sterekhova, and F. S. Kuzmina

SOME INDICES OF LIPID METABOLISM IN THE BLOOD OF WORKERS ENGAGED IN COPPER WORKS. *(Nekotoryye pokazateli lipidnogo obmean v krovi u rabochikh medeplavilnykh proizvodstv). Text in Russian. Terapevt. Arkh., 43(9):100-104, 1971. 26 refs.*

Indices of lipid metabolism were determined in the blood of 94 copper smelter workers with toxico-chemical hepatitis pneumosclerosis (in the presence or absence of hepatitis developing due to a chronic action of sulfur dioxide), and in the blood of silicosis patients and donors. All patients showed a significant increase of total lipids content compared to donors. Patients with hepatitis and silocosis showed a moderate increase in Beta-lipoproteids; other patients showed a tendency toward increased levels. The content of Beta-lipoproteids, total lipids, and Beta-lipoproteidipase activity in blood serum correlated with the extent of sclerosis in the lungs and with the inclusion of liver disease in the pathological process. Total cholesterol levels were normal in all patients, but there was a tendency toward increased estherified cholesterol.

18389 APTIC NO. 36269

Beeckmans, J. M.

THE DEPOSITION OF ASBESTOS PARTICLES IN THE HUMAN RESPIRATORY TRACT. *Int. J. Environ. Studies, vol. 1:31-34, 1970. 9 refs.*

The deposition of asbestos particles in the human respiratory tract was studied theoretically by treating them as ellipsoids of revolution, in a modified version of a method previously used to study the depositon of spherical particles. A computer program was executed for a 1000 cu cm tidal volume and a three-second breathing cycle, with 0.3 sec pauses at the end of inspiration and the end of expiration. The results show that as the eccentricity of the ellipsoids is increased at constant equatorial diameter, deposition is reduced in the diffusion-controlled particle-size region (0.02-0.2 micron). In the particle-size region above 0.2 micron where sedimentation and impaction are the controlling mechanisms, an increase in the eccentricity of the ellipsoidal particles at constant equatorial diameter is equivalent to an appropriate increase in particle density, and the deposition curves are displaced to the left. (Author abstract modified)

18390 APTIC NO. 36225

Biondi, C.

THE SYMPTOMATOLOGICAL AND PHYSIOPATHOLOGICAL DIFFERENCES OF INTOXICATIONS BY MERCURY VAPORS AND BY MERCURY COMPOUNDS. *(Ueber die Vergiftung durch Quecksilberdaempfe und Quecksilberverbindungen und die symptomatologischen und physiopathologischen Differenzen). Text in German. Arch.. Gewerbepathol. Gewerbehyg., vol. 1:754-762, 1931. 12 refs.*

Observations on mine workers in the mercury mines of Monte Amiata, Italy, carried out over a 25-year period confirmed that while intoxication by mercury compounds (cinnabar) is manifested by albuminuria, gastrointestinal disturbances, stomatitis with ulcers, and ptyalismus, intoxication by mercury vapors is manifested by cachexia, loss of weight, tremor with twitching, and psychic irritability. In the Spanish mines in Almaden, where mercury droplets are present in the mine shafts, miners are affected exclusively with the latter symptomatology. Both forms of intoxication can occur simultaneously. This happens when the temperature of the atmosphere containing mercury vapor exceeds the temperature of the mucous membranes of the respiratory organs. In such a situation, mercury condenses on the surfaces of mucous membranes and is ingested as mercury compounds but is also partly inhaled, thus producing both sets of symptoms. The tremor usually disappears after five days in an uncontaminated atmosphere; only in a very few neglected or severe cases is it permanent. Similarly, as with tetraethyl lead, diethylmercury affects the nervous system through the affinity of the diethyl group to lipids. Within certain limits, this effect is reversible.

18391 APTIC NO. 36354

Buxbaum, J.

LEAD IN THE AIR. *Preprint, Scientists Committee for Public Information, Inc., New York, 10p., Sept. 1, 1970. 20 refs.*

It is probable that the bulk of lead found in the air comes from the combustion of leaded gasoline, that the level of lead is related to the volume and speed of traffic, and that in some, but not all, communities, lead levels are increasing. About 80% of the lead burned is emitted from the exhaust as aerosol particles small enough to penetrate the depths of the respiratory passages. Recent studies suggest that lead may interact with other pollutants to render them more toxic, and that there may be no threshold for the molecular effects of lead in biologic systems; however, further research is necessary. Blood lead levels in humans seem to be closely related to their exposure to automobile exhausts. Interactions of lead in the atmosphere, plant and animal effects, and the effects of removing lead from gasoline on levels of other pollutants are briefly discussed.

18392 APTIC NO. 36284

Byczkowski, Stanislaw, Stanislaw Zawistowski, and Krystyna Wrzesniowska

HISTOLOGICAL INVESTIGATIONS OF THE EFFECT OF NITROGEN OXIDES AND OZONE ON SOME ORGANS OF LABORATORY ANIMALS. *(Badania histologiczne nad wplywem, tlenkow azotu i ozonu na niektore narzady zwierzat doswiadczalnych (cz. III). Text in Polish. Gdansk. Tow. Nauk., Rozpr. Wydz., 3(6):101-105, 1969. 9 refs.*

Chronic breathing of a mixture of nitrogen oxides with ozone in air caused changes in the interstitial tissue of rat lungs. Rats exposed to acute doses of nitrogen dioxide had changes typical of bronchopneumonia and hypertrophy of the reticuloendothelial cells of the liver. The doses of NO2 were as follows: one exposure to 200 mg/cu m of air for three hours or to 300 mg/cu m for 30 min or three exposures to 100 mg/cu m each for three hours. (Author abstract modified)

18393 APTIC NO. 36208

Byers, Randolph K., Clarence A. Maloof, and Margaret Cushman

URINARY EXCRETION OF LEAD IN CHILDREN. *(AMA J. Dis. Child., vol. 87:548-558, 1954. 7 refs.*

Diagnoses of lead poisoning were made in twenty-three of sixty-eight persons between the ages of six months and fourteen years, and, aside from any help obtained by measurement of urinary lead excretion, these were based on the presence of at least three of the major clinical signs of lead poisoning in children: secondary anemia with stippling; evidence of involvement of the central or peripheral nervous system of both; x-ray evidence of condensation of the lines of provisional calcification of the shafts of the long bones; glycosuria with normal blood sugar; abdominal complaints, and, when possible, chemical identification of the source of lead. Using a modification of Fairhall's micromethod, which uses dithizone for the preliminary separation of lead but which extracts the lead from the dithizone and analyzes it as the dichromate, accurate estimation of the 24-hour urinary lead excretion has been possible in properly collected samples. Dithizone methods of analysis for lead in unashed urine either by titration or colorimetry have proved unreliable, as did urinary concentration of lead, expressed as micrograms per liter.

18394 APTIC NO. 36403

Campbell, J. Argyll

CANCER OF SKIN AND INCREASE IN INCIDENCE OF PRIMARY TUMOURS OF LUNG IN MICE EXPOSED TO DUST OBTAINED FROM TARRED ROADS. *Brit. J. Exp. Pathol., 15(5):287-294, Oct. 1934. 9 refs.*

Mice were repeatedly exposed to dust obtained by sweepings from tarred roads that contained about two percent tar. Cancer of the skin developed in 70% of those surviving long enough. The incidence of primary adenoma of the lung increased to ten times that of the controls; the lungs of the dusted mice contained much dust. The breathing of carbon monoxide, if anything, retarded the effects of dusting. The mice were exposed to more excessive dusting than occurs with human individuals. Cleanliness prevents cancer of the skin in man, and the natural mechanism for the removal of dusts from the healthy lung may suffice for the small amounts of dust inhaled. There was also question whether the tumors in the mice could be compared with those of the human lung. (Author summary modified)

18395 APTIC NO. 36251

Castellino, N. and S. Aloj

INTRACELLULAR DISTRIBUTION OF LEAD IN THE LIVER AND KIDNEY OF THE RAT. *Brit. J. Med. (London), vol. 26:139-143, 1969. 27 refs.*

The distribution of lead in intracellular fractions of liver and kidney was studied in 46 rats for nine days after intravenous injection of 100 microgram PB(210) per rat. The radioactivity and the protein nitrogen were measured in homogenates and nuclei, mitochondria, microsomes, and cell sap. Lead was present in all fractions one hour after injection. During the first 72 hours, the relative amounts of lead in the different fractions varied, which ruled out the possibility that differences could be explained by redistribution after homogenization. The distribution of metal in the cell probably depends on differences in the nature and stability of bonding to intracellular structures. The binding of lead in the mitochondria was particularly stable, only 24.4% of the radioactivity being removed by washing with 0.25 M sucrose or 0.001 M ethylenediaminetetraacetic acid, or 0.001 M diethylenetriamino penta-acetate in 0.25 M sucrose. The stability of binding of lead in the mitochondria is in agreement with the hypothesis of direct interference by lead with some steps in haem biosynthesis, probably due to an enzymatic block of delta aminolevulinate dehydratase and haem synthetase. (Author abstract modified)

18396 APTIC NO. 36152

Chisolm, J. Julian

TREATMENT OF LEAD POISONING. *Mod. Treat., 4(4):710-728, July 1967. 15 refs.*

Plumbism results from the accumulation over a period of weeks, months, or years of an excessive body burden of lead. This burden is distrubuted between bone and soft tissues, with the major portion being stored in the bone. The cruical aspect of therapy in all age groups is prompt termination of lead exposure. Estimation of the duration of abnormal exposure provides an index of the period of time a patient will require medical supervision after exposure ends. As long as significant quantities of lead remain in the bone, any intercurrent illness that can cause demineralization can also cause mobilization of toxic quantities of lead into soft tissues and, hence, exacerbation of plumbism. Serial blood and urine lead determinations, together with coproporphyrin and delta-aminolevulinic acid measurements, provide the best index of soft tissue toxicity. Administration of chelating agents results in rapid reduction in soft tissue lead content, but not in removal of significant quantities of lead from bone. Chelating agents, therefore, do not accelerate the lead-excretion process. The most severe clinical manifestation of lead intoxication is acute encephalopathy, which is more frequent in children than in adults. Therapy must be instituted before the classic signs of increased intracranial pressure are apparent if central nervous system damage is to be prevented. Accurate lead analyses are essential for proper treatment. Laboratory tests required for diagnosis of lead intoxication in children and for monitoring occupational exposure are summarized, as are chelating agents for symptomatic and asymptomatic cases and for long-term follow-up care.

18397 APTIC NO. 36207

Chisolm, J. Julian, Jr. and Eugene Kaplan

LEAD POISONING IN CHILDHOOD - COMPREHENSIVE MANAGEMENT AND PREVENTION. *J. Pediat., 73(6):942-950, Dec. 1968. 20 refs.*

Lead poisoning in the young child is a chronic disease. It results from the impact upon the urban slum child, in particular, of a variety of causative factors-pica and environmental exposure to lead, cultural and behavioral patterns of parents, and certain aspects of lead metabolism. Each of these factors and the natural course of the disease, neurological and renal sequelae, and a program for early recognition and mass screening are discussed. Balance studies indicate that atmospheric lead pollution in urban areas has not yet reached toxic levels for the general population. Hospitalization in a chronic disease facility which has a positive program of child and family rehabilitation is important in the total care of the affected child. The roles of health departments, pediatricians, medical social workers, and child guidance workers in a team approach, and the essential aspects of an effective community prevention program, are outlined.

18398 APTIC NO. 36245

Chisolm, J. Julian, Jr., Helen C. Harrison, Walter R. Eberlein, and Harold E. Harrison

AMINO-ACIDURIA, HYPOPHOSHATEMIA, AND RICKETS IN LEAD POISONING. *Ama Amer. J. Dis. Child., vol. 89:159-168, Feb. 1955. 24 refs.*

A case of lead poisoning in a 33-month-old child is described. In addition to the usual well-known clinical findings of acute encephalopathy and anemia the patient presented hypophosphatemia, glycosuria, aminoacidura, and the skeletal changes of acute rickets. These findings appeared to be related and to be the result of a disturbance of renal tubular function due to lead. The biochemical disturbance was reversible, for the abnormalities subsequently disappeared. This disturbance was similar to that observed in the Toni-Fanconi syndrome, suggesting that the same or related tubular enzyme systems are involved in lead intoxication. The principal therapeutic effect of citrate in the patient appeared to be acceleration of the healing of rickets in the presence of lead-induced renal tubular dysfunction, with the simultaneous deposition and storage of lead in the newly formed bone. (Author summary modified)

18399 APTIC NO. 36266

Chisolm, J. Julian, Jr. and Harold E. Harrison

THE EXPOSURE OF CHILDREN TO LEAD. *Pediatrics, 18(6):943-958, Dec. 1956. 21 refs.*

Environmental, behavioral, and social factors leading to lead poisoning in urban children by ingestion of leaded-paint flakes were studied in 197 clinic patients from 1952 through 1954. The magnitude of the exposure to lead from repetitive ingestion and the role of the seasonal factor (summer) in precipitating acute lead encephalopathy were the predominant environmental factors. Levels of excreted lead in poisoned children exceeded those from exposed industrial workers. Continued environmental exposure leads to severe, permanent brain damage among survivors of an initial acute attack. Various approaches to an effective home and community prevention program are discussed.

18400 APTIC NO. 36192

Clarke, John F.

SOME CLIMATOLOGICAL ASPECTS OF HEAT WAVES IN THE CONTIGUOUS UNITED STATES. *Air Pollution Control Office, Research Triangle Park, N. C., Div. of Meteorology, 20p., 1971. 13 refs.*

The spatial distribution of episodes of extreme temperature occurring over two, five, eight, and eleven consecutive days is presented, based on data from 31 stations. Comparative data on normal temperatures are also presented. Periods of very warm and above normal temperatures, generally referred to as heat waves, present a serious threat to health. The many combinations of environmental and physiological conditions that result in heat related ailments or mortality are not well known, but age and exposure time generally influence heat-related deaths. While all sections of the country are vulnerable to heat waves, the Midwest has the highest potential and the Gulf Coast the lowest potential for heat waves in the United States. (Author abstract modified)

18401 APTIC NO. 36461

Clifton, Marjorie

HEALTH, WEATHER AND THE URBAN SCENE. *Chest and Heart Assoc. London (England), Symp. Human Environ. Respir. System, Proc., London, England 1970, 7p. 2 refs. (Oct. 20.)*

The temperature governs heating requirements and thus, indirectly, the air pollution which results from fuel combustion. The dispersion of pollutants, however produced,also depends on the weather. In southeast Lancashire in April and October 1964, the heating requirements as indicated by the number of Degree Days (accumulated temperatures below 60 F) were identical; but October pollution concentrations were much higher because the increased proportion of calms was unfavorable for dispersion. By contrast, sites in Leeds and Bradford had very similar pollution levels in October 1965 and February 1966 although the number of Degree Days showed fuel use in February was twice that of October. The much higher proportion of calms in October permitted pollution to accumulate and thus compensated for the lower emissions. Winter death rates for all causes for 16 consecutive winters, except in periods when influenza epidemics occurred, corresponded closely with average monthly Degree Days. Minimum mortality rates in the winters when the epidemics occurred correlated well with the number of Degree Days and thus inversely with temperature and positively with fuel consumption.

18402 APTIC NO. 36362

Cooper, W. Clark and Irving R. Tabershaw

BIOLOGIC EFFECTS OF NITROGEN DIOXIDE IN RELATION TO AIR QUALITY STANDARDS. *Arch. Environ. Health, vol. 12:522-530, April 1966. 55 refs.*

Data on the biologic effects of nitrogen dioxide on man and lower animals over a wide range of concentrations are reviewed and tabulated. Present evidence suggests that long-continued exposures should not exceed the range 0.5-1.0 ppm. This is based on the evidence of increased mortality in lower animals exposed to aerosolized microorganisms after NO2 exposures and the pathologic effects demonstrable in animals continuously exposed to levels in the range of 4-5 ppm. Brief exposure of a general population should not exceed 3 ppm over a period of one hour. This is based on the possible potentiation of infections and on the odor threshold. These recommendations relate to the possible effects of NO2 on health alone. They do not consider potentiation or additive effects nor any contributions to plant damage and visibility. (Author summary)

18403 APTIC NO. 36366

Crofton, Eileen C.

RECENT TRENDS IN MORTALITY FROM LUNG CANCER AND BRONCHITIS IN URBAN AND RURAL AREAS IN SCOTLAND. *Brit. J. Prevent. Social Med., vol. 24:110-115, 1970. 9 refs.*

Standardized mortality rates and age-specific death rates for lung cancer and bronchitis in Scottish males were calculated for cities and rural areas from 1951-1965. In both diseases over this period there has been an increase in the standardized rates and in every age-specific rate, except for those dying between 45 and 54 in the cities, where it has fallen slightly. The rate of increase is proportionately higher in the rural areas. At each age of death there has been a fall in the ratio between death rates in cities and those in rural areas. This has been greatest for lung cancer in the 55-64 age group and for bronchitis in the 45-54 age group. In 1951-53 the greatest difference between the rates in cities and rural areas was in the 55-64 age group; this has subsequently shifted to later age groups. A comparison of the present findings with other studies suggests that a later beginning of cigarette smoking in rural areas with a subsequent marked increase could account for many of the changes observed. Population movements, changes in atmospheric pollution, and differences in diagnosis and treatment may also play some part in the changing relationships between cities and rural areas. (Author summary modified)

18404 APTIC NO. 36398

Crow, James F.

CHEMICAL RISK TO FUTURE GENERATIONS. *Sci. Citizen, vol. 10:113-117, June-July 1968.*

The problem of chemical risk to future generations was discussed and recommendations were made. The first problem is the production of a small increase in mutation rate by chemical agents. Special attention should be given to the danger of very low concentrations of highly mutagenic compounds that might be introduced into foodstuffs or otherwise be brought into contact with large populations. The second problem is that some compounds presumed to be innocuous are, in fact, highly mutagenic and that large numbers are exposed before the danger is realized. An up-to-date register of mutagenic chemicals should be kept, and the information made generally available. Examples of assay systems employed in routine screening of chemical compounds are DNA transformation, virus systems, bacterial systems, yeast, neurospora, higher plants, drosophilia, mice, and human tissue cultures. Research to develop more sensitive and cheaper assay to mutagenicity and chromosome breakage, or assays based on organisms more closely related to man, should be encouraged and supported. The feasibility of the genetic monitoring of the human population for chromosome breakage and increased genetic disease should be explored.

18405 APTIC NO. 36283

Djuric, Dusan, Zarka Kerin, Ljubica Graovac-Leposavic, Ljiljana Novak, and Marija Kop

ENVIRONMENTAL CONTAMINATION BY LEAD FROM A MINE AND SMELTER. *Arch. Environ. Health, 23(4):275-279, Oct. 1971. 1 ref. (Presented at the Conference on Inorganic Health, Amsterdam, Netherlands, Nov. 28, 1968.)*

The comtamination of a large area in Yugoslavia by lead from a mine and smelter is illustrated in a preliminary report of fragmentary data obtained by the determination of lead in the surrounding air, in the water of a river draining in the area, in the soil, and in local vegetation. A screening test (determination of the urinary excretion of delta-aminolevulinic acid) applied to groups in the population suggests that the absorption of lead by members of the groups may be hazardous. (Author abstract)

18406 APTIC NO. 36093

Duckering, G. Elmhirst

THE CAUSE OF LEAD POISONING IN THE TINNING OF METALS. *J. Hyg., vol. 8:474-503, 1908. 2 refs.*

Tinning of metals, the coating of metal articles with lead or tin, causes lead poisoning. The atmosphere of a tinning workshop contained of hydrochloric acid, chlorides of lead, zinc, iron, and copper in the state of vapor, and metallic tin and lead. In the neighborhood of the tinning baths and wiping stands, the quantity of lead chlroide ranges from approximately two parts to sixty parts/ten million parts by weight of air. The mechanical action of escaping vapor is not nearly as important a factor in causing air contamination as the chemical action of the materials (acid and flux) used in tinning on the tinning metal and subsequent vaporization of the products of this action. Workers cannot use a respirator because of the tendency of the chlorides to condense and block the filtering material. The distribution of deleterious substances in the atmosphere of a tinning workshop was also studied. Long continued absorption of small quantities of lead is of much more importance in causing lead poisoning than the amount of the dose.

18407 APTIC NO. 36409

Durand, G.

CONFERENCE OF PROFESSOR ROUSSEL AT LILLE OF MARCH 30, 1968. *(Conference a Lille de professeur Roussel). Text in French. Preprint, Association Technique de la Siderurgie Francaise, Paris (France), Commission Eau et Pollutions Atmospheriques, 4 p., 1968. (Presented at the Association Technique de la Siderurgie Francaise, Commission Eau et Pollution Atmospherique Meeting, Oct. 14-15, 1968, CT/MTP Service 526 No. E-PA 68-35.)*

The observations made by the director of atmospheric pollution research of the National Institute of Health and of Medical Research at Vesinet, on the subject of pollution by particulates, gas, and aerosols in cities and industrial agglomerations are discussed. It is very difficult to define pollution precisely, and even more difficult to set maximal permissible levels. Aerosols are generally kept below the five micron/cu m concentration by mucous membranes; beyond this concentration they penetrate pulmonary alveoli where their attack is direct. Studies performed in the laboratory and epidemiological studies carried out by statistical methods were discussed. The latter bear on mortality and morbidity. Large-scale accidents furnish valuable information. Thus, the four biggest recent episodes (Meuse valley in Belgium, Donora in the U.S.A., London in England, and Posa Rica in Mexico) were all caused by concentrations of pollutants generally thought to lie below the toxic level. Minor pollution causes skin and mucous membrane lesions, rachitis in children, rhino-pharyngeal infections and otitis, gastric, allergic, and cardiac affections, asthmatic attacks, fatigue, and eye irritation. Mortality from cancer is higher in urban than in rural areas and pollution, especially from automobile exhaust gases, is a contributory factor.

18408 APTIC NO. 36327

Epstein, Samuel S. and H. Shafner

CHEMICAL MUTAGENS IN THE HUMAN ENVIRONMENT. *Nature (London), vol. 219:385-387, July 27, 1968. 13 refs.*

Preliminary data on the feasibility of mutagenicity testing in mice was based on screening a wide variety of environmental pollutants, including carcinogens, air and water pollutants, pharmaceuticals, food additives, and pesticides. In the dominant lethal test, treated males were sequentially mated with groups of females. The females subsequently were dissected at the midaterm of pregnancy to evaluate the incidence of dominant lethal mutations. Some effects reflected mutagenic activity and represented fetuses killed in utero by mutations directly induced in male germ cells. The possibility of systemic drug effects in females was thus excluded. Among the carcinogens tested, aflatoxin and benzo(a)pyrene were mutagenic. The effects of methyl methane sulfonate were mutagenic at week two and declined to control levels at week three.

18409 APTIC NO. 36224

Fairchild, Edward J., II, Sheldon D. Murphy, and Herbert E. Stokinger

PROTECTION BY SULFUR COMPOUNDS AGAINST THE AIR POLLUTANTS OZONE AND NITROGEN DIOXIDE. *Science, vol. 130:861-862, Oct. 1959. 14 refs.*

Tests were conducted involving the inhalation exposure of mice to an approximate LC50 of either ozone or nitrogen dioxide simultaneously with one or more sulfur compounds. In some instances the sulfur compounds were administered intraperitoneally before oxidant inhalation. Mortality from a 4-hour exposure, compared with a control exposure to oxidant alone, reflected enhancement or suppression of oxidant toxicity. Results showed two distinct but related pathways of protection against the lethal effects of 03 and NO2 by simultaneous inhalation of compounds that furnish -SH or -SS-, or both, and by injection of thiourea derivatives several days prior to exposure to these oxidant gases. The mechanism of -SH and -SS- is believed similar to that proposed for the action of radiation-protective compounds. The mechanism for protection by thiourea derivatives involves the development of a tolerance initiated by the thiourea against the oxidants.

18410 APTIC NO. 36217

Ferris, B. G., I. T. T. Higgins, M. W. Higgins, J. M. Peters, W. F. Van Ganse, and M. D. Goldman

CHRONIC NONSPECIFIC RESPIRATORY DISEASE. BERLIN, N.H., 1961-1967 - A PROSPECTIVE STUDY. *Preprint, American Medical Association, Chicago, Ill., 31p., 1970. 6 refs. (Presented at the Air Pollution Medical Research Conference, New Orleans, La., Oct. 5-7, 1970.)*

A longitudinal study, in which community exposure to pollutants is related to the development or course of respiratory disease or to changes in lung function was conducted in Berlin, N. H. Complete smoking histories were obtained. After completion of a questionnaire, five forced vital capacities on a recording spirometer were performed by each subject. Lead peroxide candles and high volume samplers were used to determine the air pollution. Results showed lower disease prevalences in 1967 than in 1961 after standardizing for age, sex, and smoking habits. Some of the pulmonary function tests were slightly better in 1967. Levels of air pollution were lower in 1967. The decrease in air pollution could account for the decreased disease prevalence and slight improvement in pulmonary function.

18411 APTIC NO. 36241

Fishburn, C. W. and Carl Zenz

METAL FUME FEVER. A REPORT OF A CASE. *J. Occup. Med., 11(3): 142-144, March 1969. 5 refs.*

The clinical syndrome of metal fume fever in a man exposed to heavy concentrations of metal oxides was described. The medical history was given. This condition is characterized by chills, fever, nausea, vomiting, muscular pain, dryness in the mouth and throat, fatigue, headache, and weakness. The symptoms usually abate in 24 to 48 hours with complete recovery following. If daily exposure occurs, such as in a brass foundry, where zinc and copper alloys are being produced, an immunity appears. Metal fume fever is attributed to oxides of nickel, copper, cadmium, iron, mercury, titanium, magnesium, and other metals. Multiple exposures to metal oxides, nitrogen oxides, ozone, and heat had occurred in this case. The patient described similar symptoms on previous exposures sustained in closed jobs at other welding operations. The symptoms described on three days of welding, were primarily due to the heavy exposure of metal oxide fumes. The secondary exposures to ozone, nitrogen oxides, and heat could not be verified. The interpretation of a routine zymogram, indicating an environmental exposure followed by pneumonitis is unique and suggests that this laboratory technique might be of value in the differential diagnosis of acute pulmonary symptoms. When used properly in the hands of skilled individuals, atomic absorption spectroscopy proves to be a rapid and accurate method for blood metal determinations.

18412 APTIC NO. 36363

Frank, N. R., M. O. Amdur, and J. L. Whittenberger

A COMPARISON OF THE ACUTE EFFECTS OF SO2 ADMINISTERED ALONE OR IN COMBINATION WITH NACL PARTICLES ON THE RESPIRATORY MECHANICS OF HEALTHY ADULTS. *Intern. J. Air Water Pollution (London), vol. 8:125-133, 1964. 29 refs.*

Changes in the pulmonary flow resistance (R1) of healthy male adults, induced by three levels of sulfur dioxide: 1-2, 4-6, and 14-17 ppm, were compared when the gas was administered alone or in combination with submicronic sodium chloride aerosol. The subjects were seated in a volume-displacement body plethysmograph, breathing by mouth. At least one month transpired between exposures. No systematic differences were found between the responses to the gas alone and to the gas-aerosol mixture. Essentially the same dose-response relations occurred in both circumstances: that is, the group showed no change in R1 during exposure to 1-2 ppm of SO2, and showed a smaller increase to 4-6 ppm than to 14-17 ppm. In a second type of experiment the gas and gas-aerosol mixture were administered one after the other, separated by a 15 min period of room-air breathing. The response to the second exposure, whether it was the gas alone or the mixture was smaller than the response to the first exposure. (Author abstract)

18413 APTIC NO. 36370

Frank, N. R., E. Yokoyama, S. Watanabe, D. E. Sherry, and J. D. Brain

AN OZONE JOURNAL. *Preprint, American Medical Association, Chicago, Ill., 20p., 1970. 10 refs. (Presented at the Air Pollution Medical Research Conference, New Orleans, La., Oct. 5-7, 1970.)*

A series of investigations being conducted on the functional effects of ozone is described. In the first set of experiments, the uptake of ozone by the isolated upper airways was measured in dogs. Nasal uptake was higher than oral uptake, but both nasal and oral uptake were inversely related to the flow rate. About 80-85% of the ozone that entered the lower airways, in further experiments to determine the uptake by the lower airways and the alveoli, was taken up. Animals were anesthetized, paralyzed, and ventilated with a respiratory pump that was designed to minimize the uptake of ozone. Then, pulmonary flow resistance, pulmonary compliance at three frequencies, a slow volume-pressure curve in which the change in volume represented essentially the animal s vital capacity, and the end expiratory thoracic gas volume were measured. Diffusion capacity and effective lung volume were also determined. New Zealand white rabbits of both sexes were tranquilized and the left lung collapsed by a pneumothorax; the animal was then placed in a restraining box with its head protruding into a leucite exposure chamber. Following three hours of exposure of just the ventilating right lung to a mean concentration of either 5.2 plus or minus 0.1 ppm or 1.9 plus or minus 0.2 ppm ozone, the animal was returned to its quarters. Re-expansion of the left lung appeared complete within 48 hours. On the seventh or eighth day, both lungs were challenged by a mean of 18.9 plus or minus 0.4 ppm ozone for three hours, a dose deliberately intended to produce edema.

The animals were then killed, and the right and left lungs excised and separated. Slow volume/pressure measurements were made on each lung.

18414 APTIC NO. 36228

Fraser, A. M., K. J. Melville, and R. J. Stehle

MERCURY-LADEN AIR: THE TOXIC CONCENTRATION, THE PROPORTION ABSORBED, AND THE URINARY EXCRETION. *J. Ind. Hyg., 16(2):77-91, March 1934. 17 refs.*

In order to determine the minimal toxic or injurious concentration of mercury vapor in air, normal dogs were exposed to various concentrations of mercury vapor and the effects observed. Detailed observations are described concerning the development, course, and outcome of the chronic types of intoxication which could be produced experimentally. The daily urine output, daily urinary excretion of mercury, and proportion of inhaled mercury which is expelled in the expired air were determined and, from the data obtained, the amount of mercury retained in the body was calculated. The minimal concentration of vapor which led invariably to chronic toxic effects under similar conditions of exposure was 3.05 mg per cu m. If man and the dog are equally susceptible to mercury vapor, one would expect the urine of man to contain about 3 mg mercury per day or less when symptoms of poisoning first became apparent. With concentrations ranging from 2.91 to 26.18 mg of mercury per cu m of inhaled air, the proportion absorbed was to 21.3-26.6% of the amount inhaled.

18415 APTIC NO. 36259

Frontczak, Andrzej

THE EFFECT OF THE KIND OF RESPIRATION AND OF THE AIR IRRITATING THE RESPIRATORY TRACT ON THE VITAL CAPACITY OF THE LUNGS. *(Zachowanie sie pojemnosci zyciowej pluc w zaleznosci od rodzaju oddychania orz w srodowisku powietrza drzniaccgo drogi oddechowe). Preprint, Third Clinic of Internal Diseases A. M., Lodz (Poland), p. 592-593, 1961. (Presented at the TIP, 21st Meeting, Warsaw, Poland, Sept. 14-16, 1961. Translated from Polish. Scientific Translation Service, Santa Barbara, Calif., 6p.*

Vital capacity of the lungs was determined by a Barnes spirometer in a group of 88 healthy persons, 58 men and 22 women, between 18 and 30 years of age. Three methods were employed: the vital capacity of the lungs was measured in the classical way, with the open nose; with a closed nose; and while the person investigated made the deepest inhalation through his nose while having his mouth closed, and the deepest exhalation through his mouth, having his nose closed. The vital capacity of the lungs determined by Method II was, on the average, smaller by 360 cu cm than the capacity determined by the classical procedure. In another part of the experiment, fifty healthy men were exposed to an environment which contained hydrogen sulfide before calculating vital capacity. The observed reduction of the lung vital capacity in an environment of air irritating the respiratory tract is real and statistically significant.

18416 APTIC NO. 36338

Gangolli, S. D.

ANALYTICAL CHEMISTRY IN TOXICITY TESTING. *Chem Brit., 5(11):510- 513, Nov. 1969. 10 refs.*

Analytical chemistry contributes to three basic aspects of toxicity testing. (1) Composition of the test compound. Specifications of synthetic compounds for food additives are primarily concerned with the industrial application of the product rather than with the requirements of toxicologists. The presence of unspecified but toxic impurities varying from batch to batch may contribute to the toxicity of the product without altering the physical characteristics stipulated in the specifications. However, information on the composition of a food additive could be of considerable importance in the elucidation of the toxicity and hence in the manufacture of safer food additives. (2) Early detection of toxic damage. Blood and urine samples collected serially from animals during the course of a toxicity study are biochemically examined. This involves hematology; the estimation of normal biological constituents, e.g. proteins, glucose, urea; and diagnostic enzymology. After detecting the target organs involved, a logical sequence is the study of the mechanism of tissue injury at the cellular and subcellular level. (3) Study of the metabolism of a compound. This is probably the most significant and complex role. One consideration must be the ability of the test animals to metabolize the substance in a manner similar to man.

18417 APTIC NO. 36227

Gelman, J. and G. Derviz

THE PROBLEM OF THE FATE OF MERCURY FUMES AND MERCURIAL COMPOUNDS IN THE ORGANISM. *J. Ind. Hyg. Toxicol., 19(6):215-224, June 1937. 16 refs.*

The lengthy action of small concentrations of mercury fumes produces a specific form of chronic nervous mercurialism with specific symptomatology (tremor, erethism, encephalopathy) and the complete absence of, or only minor injury to the excretory organs. In contrast, poisoning with metallic mercury and mercuric salts does injure the excretory organs (salivary glands, mucous of the mouth, intestines, and kidneys) without specific injury to the nervous system. This difference in toxic action is caused by the different physical-chemical states of mercury and the different fates of the mercury fumes and the mercury salts in the organism. Experiments were conducted to determine (1) whether the mercury entering the blood as fumes and compounds (bichloride of mercury) differs in volatility, and (2) in what state mercury circulates in the animal organism (mice) in chronic poisoning by mercury fumes. Results indicated that mercury fumes are preserved in the blood in a state of atomic dispersion for a period of time; mercury salts enter into intricate complex combination with blood albumins. (Author summary modified)

18418 APTIC NO. 36155

Gocke, Thomas M.

WHAT IS THE ROLE OF AIR POLLUTION AS A CAUSE OF DISEASE? Am. J. Public Health, 54(1):71-78, Jan. 1964. 17 refs.

Air pollution episodes in Donora, Pennsylvania, and London, England, have stimulated an investigation into clinical effects of air pollution. Another type of pollution exists in Los Angeles, where thermal inversions lead to stagnation of air during approximately 100 days out of the year. The widespread effect of this smog is eye irritation with tearing and redness. Asthma attacks, other respiratory diseases, and cardiovascular complications due to acute episodes of pollution are mentioned. Evidence relating bronchitis mortality and morbidity to long-term exposure to low concentrations of air pollution is strongest in the United Kingdom. Other epidemiological studies are cited which indicate respiratory symptoms may result from chronic exposures to low levels of pollutants.

18419 APTIC NO. 36361

Gore, A. T. and C. W. Shaddick

ATMOSPHERIC POLLUTION AND MORTALITY IN THE COUNTY OF LONDON. *Brit. J. Prevent. Social Med. (London), vol. 12:104-113, 1958. 10 refs.*

An examination of mortality experienced in London during periods of fog in association with indices of atmospheric pollution suggests a critical level four times the customary winter average of atmospheric pollution above which a fog will cause marked immediate excess mortality. By the methods used in the investigation, no significant relationship between mortality and exposure to smoke and sulfur dioxide was demonstrated over a two-year period. A critical level of one or both in combination that would be directly associated with increased mortality is not excluded. There may also be other types of pollutants more dangerous than either. Living in London for a long period is considered to increase the risk of dying from respiratory disease, particularly bronchitis. A crude index, percentage born in London, had to be used as a measure of the length of residence. If the Clean Air Act of 1956 has the effect of reducing the amount of smoke in the atmosphere it may be possible to assess with greater clarity the respective parts played by sulfur dioxide and smoke. (Author summary)

18420 APTIC NO. 36276

Harington, J. S., Klara Miller, and Gwen Macnab

HEMOLYSIS BY ASBESTOS. *Environ. Res., 4(2):95-117, April 1971. 63 refs.*

Chrysotile asbestos hemolyzes erythrocytes within 10 minutes and over a wide range of pH. Other forms of asbestos show varying hemolytic activities which are related to the magnesium:silicon ratio of each form studied. Erythrocytes from different species of animals show different degrees of hemolysis when exposed to chrysotile, amosite, and crocidolite. The length of time during which erythrocytes are exposed to relatively inactive forms of asbestos should also be considered. Amosite and crocidolite show greater hemolytic activities when allowed to react with erythrocytes over four hours instead of one. Ethylenediaminetetraacetic acid effectively prevents hemolysis by chrysotile and other asbestiform materials containing magnesium as a formal part of the lattice. This prevention is pH dependent, however. Sialic acid is even more effective as a preventive agent then EDTA, suggesting that it may contribute the main anionic groups which react with the positively charged magnesium ions on the surface of chrysotile during hemolysis. Poly-2-vinylpyridine- 1-oxide, an effective inhibitor of hemolysis by silica powder, has little effect on hemolysis by chrysotile. This again accords with the suggestion that magnesium is the principal agent in hemolysis by asbestos. An association exists between cytotoxicity and hemolytic activity of various forms of asbestos and other minerals, although the significance of this is not yet clear. (Author abstract)

18421 APTIC NO. 36141

Harris, Robert J. C.

CANCER AND THE ENVIRONMENT. *Int. J. Environ. Studies, vol. 1:59-65 1970. 39 refs.*

It has been estimated that 80-90% of cancer in man is determined by his environment. The problem is reviewed with reference to the natural external environment sunlight, air, food, and water and to the cancers which are the result of known pollutants. Occupational cancers are mentioned. Cultural cancers, such as lung cancer from cigarette smoking, can be completely abolished. Therapeutic cancers from diagnostic and remedial medicine are under surveillance. The contribution to cancer morbidity of man s internal environment is hard to assess and difficult to alter. Single factors can only be isolated in animal experiments. Man, himself, is subject to complex interactions between multiple external factors and an internal environment which may be more or less aberrant. Almost nothing is known about such interactions. Cleaning the environment can lead to fast results in reducing cancer morbidity. Quicker progress might be made if known procedures for diagnosing the disease were applied more vigorously to high-risk populations and if new methods were sought for readily distinguishing these groups. (Author abstract modified)

18422 APTIC NO. 36540

Holscher, Helmut

FIFTY YEARS OLDS SHOULD TAKE CARE OF THEIR LEGS. *(Fuenfzijaehrige sollten auf ihre Beine achten). Text in German. V.D.I. (Ver. Deut. Ingr.) Nachr. (Berlin), 25(38):2, Sept. 1971.*

Experiments with rabbits showed that after passive smoking of only twelve cigarettes, the blood cells responsible for the blood coagulation began to adhere to the walls of veins and arteries. For the experiments the animals were locked into a cage into which the smoke of a dozen cigarettes was blown within one hour. The animals were killed afterwards and parts of the aorta were examined under the electron microscope. The previously smooth wall of the blood vessels showed obstacles in form of blood cells which had settled on the wall and which had grown into the wall. The experiment with the rabbits does not prove that the blood cells stay there forever, nor does it prove that exactly the same reaction is triggered in humans. It shows, however, that even passive smoking causes an abnormal reaction.

18423 APTIC NO. 36129

Horiuchi, Kazuya, Hirokazu Noma, Isao Asano, and Kenji Hashimoto

STUDIES ON THE INDUSTRIAL LEAD POISONING. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN HUMAN BEING THROUGH THE RESPIRATORY TRACT. *Osaka City Med. J. (Japan), 8(2):157-169, 1962. 24 refs. (Presented at the Japan Association of Hygiene, Annual Meeting, 30th, 1960.)*

A lead acetate solution was given to two normal Japanese adult males through the respiratory tract with new inhalation apparatus in five stages: 1 mg/day for 61 days; 2 mg/day for 31 days; and 2.5 mg/day for 50 days. In the fourth stage, the lead intake was discontinued for 42 days and in the fifth stage thiocitic acid and Na2Ca-EDTA were given for treatment. It was found that lead intake is recovered most rapidly in the urine, followed by the feces and blood. Forty to fifty percent of the lead given through the trachea was excreted in the urine and feces and the rest remained in the body. The red blood cell count and hemoglobin content decreased following the lead administration. Thrombocyte count increased in the early stages of lead absorption. In the myelogram of one subject, the number of erythroblasts increased during the early stages of lead absorption. Basophilic and polchromatic macroblasts also increased in both subjects during the lead absorption period, while normochromic normobalasts decreased in the last stage of lead absorption. Several liver function tests revealed that the amount of lead intake had little effect on normal liver function. (Author summary modified) 0

18424 APTIC NO. 36830

Iko, Kozo, Miyoko Ueda, Itsuo Gamo, Tadahiko Shimizu, Shigemichi Sugawara, Yoshizo Tsunetoshi, Kyoichiro Toshima, Chikara Nasu, Noriko Nakayama, Masaru Nishida, Sadayuki Nishimoto, Masateru Yasuoka, and Kotaro Wakasugi

INVESTIGATION OF ACUTE INFLUENCES. *(Kyusei eikyo chosa). Text in Japanese. In: Report on the effect of soot and dust in Osaka Prefecture. Liaison Committee of Air Pollution in Kinki District (Japan), p. 7-35, 1969 (?).*

Two investigations were made to study the number of patients with diseases caused by air pollution in Nishiyodogawa district in Osaka City. Patients with diseases directly connected with air pollution and children with asthma were studied. The number of patients with diseases directly connected with air pollution, such as chronic bronchitis, asthma, asthmatoid bronchitis, and pulmonary emphysema was counted based on the receipt of social insurance treatment during Jan. to March in 1970 in all medical care organizations in Nishiyodogawa district. The number of patients with the four diseases was 2,115 of whom 53 (2.5%) were applicants for legal recognition of the disease. Chronic bronchitis and asthmatoid bronchitis were frequently observed in highly polluted areas. Conjunctivitis which was deeply related to air pollution among ophthalmologic patients and tonsillitis and pharyngitis among otorhinologic patients was investigated. The relationship between the number of patients and the concentration of pollution was not found in the former cases, while the latter cases showed the correlation that the number of patients increased with the concentration. Children with asthma who had complained of asthma or asthmatoid symptoms on questionaire forms were examined. Ninety took medical examinations and 2.8% of all the children in Nishiyodogawa district were diagnosed with asthma and 2.5% with bronchitis with asmatoid symptoms. These children were classified by intracutaneous reactions for allergy, blood examination, and relationships between those results and manifestations. The time of manifestation is different between intracutaneous reaction-positive patients with increased enosinophiles and negative-reaction patients without any increase of enosinophiles. However, further investigation seems to be necessary to clarify the correlation between air pollution and these findings.

18425 APTIC NO. 36400

Ishikawa, S., D. H. Bowden, V. Fisher, and J. P. Wyatt

THE EMPHYSEMA PROFILE IN TWO MIDWESTERN CITIES IN NORTH AMERICA. *Arch. Environ. Health, vol. 18:660-666, April 1969. 7 refs. (Presented at the American Medical Association Air Pollution Medical Research Conference, Denver, Colo., July 24, 1968.)*

The prevalence and severity of pulmonary emphysema was studied -utilizing a series of postmortem lungs obtained from long-time residents in two cities -- a heavy industrialized urban community (St. Louis) and a prairie agricultural city (Winnipeg, Canada). A series of 300 adult lungs (left side) were collected from each city. Occupational and smoking histories were obtained from next of kin. There was considerably more emphysema in St. Louis than Winnipeg, and the anatomic emphysema was found much earlier and appeared to progress more rapidly. In neither city were cases of severe emphysema (over 70% of the lung having emphysematous destruction) observed in non-smokers. Thus, it appears that smoking is not the only factor in the development of emphysema. The importance of environmental pollution is strengthened by the fact that the incidence of severe emphysema in comparable groups of cigarette smokers is four times as high in St. Louis than in Winnipeg. The development of emphysema may be related to a synergistic effect of smoking and environmental pollution. The sharp distinction between emphysema profiles of the two cities further emphasizes the epidemiologic value of correlating various parameters of urban living with patterns of lung pathology. (Author summary modified)

18426 APTIC NO. 36267

Jaeger, M. J. and A. Bouhuys

LOOP FORMATION IN PRESSURE VS. FLOW DIAGRAMS OBTAINED BY BODY PLETHYSMOGRAPHIC TECHNIQUES. *Prog. Resp. Res., vol. 4:116-130, 1969. 25 refs. (Presented at the International Symposium on Body Plethysmography, Nijmegen, Netherlands, 1969.)*

Seven possible causes of loop formation in pressure vs., flow diagrams obtained by body plethysmographic techniques are reviewed. They are related to (1) inertance of gas in the airways; (2) variations of airway dimensions; (3) variations of lung volume; (4) variations of the respiratory exchange ratio during the breathing cycle; (5) differences of gas temperature and water vapor content in inspired and expired gas; (6) inhomogenous ventilation of parallel lung compartments; and (7) inadequate frequency response of sensing and recording equipment. The effect of unequal ventilation of parallel lung compartments on plethysmographic recordings is analyzed using an analogue computer simulation scheme. (Author summary modified)

18427 APTIC NO. 36047

Jech, J.

THE RELATIONSHIP OF AIR POLLUTION TO VALUES OF FORCED EXPIRATORY VOLUME IN TEN-YEAR-OLD CHILDREN. *(Vztah znecisteni ovzdusi k hodnotam rozepsaneho vydechu u destiletych deti). Text in Czech. Cesk. Hyg. (Prague), 16(4/5):130-134, 1971. 13 refs.*

Short experiments with high concentrations of sulfur dioxide and solid particles lead to the conclusion that, as a reflex effect and by the direct action of the pollutants upon the epithelium and the mucous membrane, the respiratory passages are restricted, resulting in an increased resistance to the breathing function. The long term effect of polluted air on the breathing characteristics of children was the subject of a study made in Bohemia with 750 children aged 10 who were selected from regions of heavy and clean air pollution for reference and comparison. The basis of the experiments was determination of forced expiratory volume (FEV) and forced vital capacity (FVC) of air obtained in time units of 0.05, 0.75 and 1.00 seconds. Three to five recordings from each child were made, using a Unispirex Prema apparatus for producing the graphs. The values of FEV and FVC, i.e., the amounts of exhaled air, were lower with children from regions with polluted air.

18428 APTIC NO. 36105

Kittel, G.

POSSIBILITIES IN OLFACTOMETRY. FATIGUE MEASUREMENTS AMONG SMOKERS. *(Moeglichkeiten der Olfaktometrie. Ermuedungsmessungen bei Rauchern). Text in German. Z. Laryngologie, Rhinologie, Otologie, 49(6):376-386, June 1970. 12 refs. (Presented at the Vereinigung Suediwestdeutcher Hals-Nasen-Ohrenaerzte, 53rd Meeting, Erlangen, West Germany, Sept. 26-28, 1969.)*

Only a few olfactometric methods are suited to exact investigation. Modern olfactometry requires the precise determination of test volumes, pressures, temperatures, and humidities; determination of rapid changes in odor concentrations, impulse intensity, and neutral stimuli is required. The recommended olfactometer relies on the volumetric method but it is more accurate than other methods. Unlike the other senses, olfaction is subject to fatigue; ways of avoiding fatigue by using an odor chamber are described. Exact threshold and fatigue values were determined for smokers. The threshold for acetone is directly related to tobacco consumption; heavy smokers have a threshold three times higher than nonsmokers. The fatigue time of heavy smokers is half that of nonsmokers. The heightened threshold and short fatigue time explain the lack of discrimination of smokers for most food flavors. The threshold shift among smokers affects certain occupations and plays a part in appetite regulation, gastric juice production, and digestion.

18429 APTIC NO. 36462

Kreyberg, L.

THE OCCURRENCE OF LUNG CANCER IN NORWAY. *Brit. J. Cancer (London), vol. 8:209-214, 1954. 4 refs.*

The figures from the official Norwegian mortality statistics were analyzed for the background of the occurrence of different histological types of primary epithelial lung tumors. The years studied were 1929-1952. In females, the ratio of the different tumor types has not changed appreciably, and the increase in lung cancer in females was taken as an indicator of the increased diagnostic efficacy. In males, a relative increase in the number of squamous cell, large-cell, and small-cell carcinomas has recently occurred, at the same time, a pronounced deviation in the mortality rates between the two sexes developed. Accepting a four-and-half-fold increase in lung cancer in females as caused by better diagnosis, the difference between this figure and the seven fold increase registered in males represented the real increase in the development of lung cancer in males. The histological sub-division of the primary epithelial lung tumors into different histological and biological entities is very useful in an analysis of the actual development of such tumors. (Author summary modified)

*18430* *APTIC NO. 36222*

*Lapp, N. LeRoy and Robert E. Hyatt*

*EVALUATION OF LUNG MECHANICS IN EPIDEMIOLOGIC STUDIES. Bull. Physio.-Pathol. Respir. (Nancy), vol. 6:595-604, July-Sept. 1970. 30 refs.*

Recent developments in the field of lung mechanics, with special reference to epidemiologic studies, are reviewed. Standard ventilatory tests cannot detect alterations in the small intrathoracic airways. Resistance measurements reflect the pressure-flow behavior of the large intrathoracic and extrathoracic airways in their resting, noncompressed state. Maximal expiratory flows, developed during the forced expiratory vital capacity (FVC) maneuver, reflect an interplay among airway geometry, airway compressibility, and lung elastic recoil. Because of the potential dissociation between measurements of resistance and maximal expiratory flow, tests involving both aspects are recommended for epidemiological studies of obstructive pulmonary disease. Two possible techniques for measuring the behavior of airways in the noncompressed state are body plethysmography and the oscillation method of obtaining respiratory resistance. For evaluating the compressed airway state, flow-volume curves of the FVC maneuver are recommended. The behavior of the terminal part of flow-curves, resistance at lung volumes below functional residual capacity, and nitrogen-washout curves may be able to provide information about the peripheral airways. (Author abstract modified)

18431 APTIC NO. 36465

Lawther, P. J.

CHRONIC BRONCHITIS AND AIR POLLUTION. *Roy. Soc. Health J. (London), vol. 79:4-9, 1959. 11 refs.*

The relevance of air pollution to chronic bronchitis was discussed. Pollution was classified as acute, sub-acute, and chronic. Acute pollution accumulates in towns during low temperature inversions and is often accompanied by persistent fog. Sub-acute pollution frequently occurs on winter evenings when high levels are reached for short periods. Town dwellers are exposed to chronic pollution most of the winter; any comparison of this dirty air with acute pollution is fraught with academic peril. Support for the hypothesis that chronic air pollution causes and aggravates respiratory disease is afforded by the comparison of mortality statistics in areas of different population density. The significance of mortality statistics is radically altered when they are used in the study of the effect of acute pollution; they acquire different limitations. They are used to reveal the severity of smog disasters in terms of death. Morbidity statistics can throw light on the evolution of chronic bronchitis. Epidemiologic studies are discussed.

18432 APTIC NO. 36459

Leiter, Joseph, Michael B. Shimkin, and M. J. Shear

PRODUCTION OF SUBCUTANEOUS SARCOMAS IN MICE WITH TARS EXTRACTED FROM ATMOSPHERIC DUSTS. *J. Nat. Cancer Inst., 1942:155-165. 26 refs.*

Nine specimens of atmospheric dust were collected from various locations, using cloth filter bags in Chelsea and Cambridge, Mass., and Pittsburgh; electric precipitation in Chelsea and Pittsburgh; and labyrinth precipitation in the case of both intake and exhaust air at the New York and New Jersey ends of the Holland Tunnel. Subcutaneous injection, into male C3H mice, of 20 mg of unextracted dust (six specimens) in saline, or of 0.25 cc of tricaprylin alone, did not produce sarcomas at the site of injection in 12 months. A snigle subcutaneous injection of about 50 mg of tar, extracted from these dusts by benzene and by ethyl ether and dispersed in tricaprylin, produced sarcomas at the site of injection in 18 of an effective total of 291 mice (strain C3H males and strain A mice of both sexes) in 12 months. (Author summary modified)

18433 APTIC NO. 36231

Loreti, Franco

EXPERIMENTAL CHRONIC TOXICITY SUBSEQUENT TO THE INHALATION OF MERCURY VAPORS. *(Sull intossicazione sperimentale cronica per inalazione di vapori mercuriali). Text in Italian. Arch. Farmacol. Sper. (Rome/Siena), vol. 48:353-361, 1930. 18 refs.*

Continuous inhalation of mercury vapors for about seven hours resulted in death within 25 days of four of the six cats investigated. Of the remaining six cats, two survived for about 45 days. The animals presented symptoms similar to those seen during Hg poisoning in man: marked tremor, body weight loss (400-500 grams), alterations in the color and texture of the hair, gingival ulcerations, oral and dental lesions, appetite loss, diarrhea, polyuria, and poor general condition. Anatomic-pathologic examination revealed intestinal and gastric lesions, fatty degeneration of the liver and of the kidney (especially the cortex). Histochemical testing did not reveal the presence of Hg in the kidney, liver, and intestines. Examination of the nervous system revealed alterations at the level of the motor nervous ends, spinal ganglia, and myelin.

18434 APTIC NO. 36190

Mauzerall, D. and S. Granick

PORPHYRIN BIOSYNTHESIS IN ERYTHROCYTES. III. UROPORPHYRINOGEN AND ITS DECARBOXYLASE. *J. Biol. Chem., vol. 232:1141-1162, 1958. 28 refs.*

An enzyme preparation which converts uroporphyrinogen to coproporphyrinogen was isolated from rabbit reticulocytes by zone electrophoresis on starch. Uroporphyrinogen I is decarboxylated at about one-half the rate of isomer III. Porphobilinogen, delta-aminolevulinic acid, and uroporphyrinogen are not decarboxylated by this preparation. The autoxidation of uroporphyrinogen is photocatalytic and is sensitized by the product, uroporphyrin. An intermediate state in the oxidation of uroporphyrinogen characterized by the intense absorption at 500 millimicron has a dipyrrylmethene-type structure. This porphomethene is not involved in the enzymic decarboxylation. (Author summary modified)

18435 APTIC NO. 36407

Mel nikova, E. A.

THE TOXICITY OF HIGHLY DISPERSED AEROSOLS OF CADMIUM OXIDE. *Farmakol. i Toksikol. (Moscow), vol. 21:179-184, 1958. 10 refs.*

The chronaxie and conditioned reflex activity in acute and chronic exposure to cadmium aerosols was investigated in white rats. A highly dispersed aerosol of cadmium oxide entering the body by inhalation is able to change the functional state of the central nervous system, which leads to disorders of the conditioned reflex activity of the animals and a lowering of the excitability of the motor apparatus. On a single exposure of an animal to cadmium oxide in threshold concentrations (0.013 to 0.018 mg/l), disturbance of conditioned reflex activity precedes the appearance of other signs of poisoning, and is to some extent reversible, which means that a concentration of 0.013 to 0.018 mg/l is considerably above the threshold for a single exposure to the poison. Repeated administration of cadmium oxide to the animal in concentrations of 0.0018 to 0.002 mg/l leads to disturbance of conditioned reflex activity, although there is no change in the general condition and behavior of the animals. The disorders of the conditioned reflex of animals in acute and chronic poisoning are analogous and are shown as lengthening of the latent periods, reduction in the magnitude of the reflexes, and the appearance of hypotonic phases. Changes in the chronaxie are different in acute and chronic poisoning. In the first case, the chronaxie was affected more in the extensor group, in the second in the flexor group.

18436 APTIC NO. 36534

Needleman, Herbert L., Orhan C. Tuncay, and Irving M. Shapiro

LEAD LEVELS IN DECIDUOUS TEETH OF URBAN AND SUBURBAN AMERICAN CHILDREN. *Nature (London), 235(5333):111-112, Jan. 14, 1972. 3 refs.*

Lead levels in deciduous teeth from children in a Philadelphia ghetto and in 49 teeth from children in suburban areas were determined by atomic absorption spectrophotometry. The mean tooth lead for suburban children was 11.1 plus or minus 14.8 ppm versus a mean of 51.1 plus or minus 109.0 ppm for ghetto children. Eleven children in the suburban group had tooth lead levels of 2 ppm or less, and four had levels too low to be detected. No urban children had lead levels below 2 ppm, and one child had a level of 110 ppm. These findings may be due to differences in atmospheric lead in the city and suburbs. In areas where lead eating by children is frequent, tooth lead levels are elevated.

18437 APTIC NO. 36809

Nose, Yoshikatsu, Sekio Ueno, and Masako Nakayama

AIR POLLUTION CONTROL AND ITS EVALUATION OF THE SEVERAL CITIES IN YAMAGUCHI PREFECTURE. *(Yamaguchiken shotoshi no taiki osen taisaku to sono hyoka). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):199, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The effect of air pollution on human health was evaluted from the viewpoint of immunogenetics. Data obtained at several cities in Yamaguchi Prefecture during 1945-1969 were analyzed in terms of the pollutant concentration and mortality rate. The components of the deposited particulate matter were classified into two groups, soluble and insoluble substances, and analyzed in relation to the mortality rate by bronchitis, asthma, and heart diseases. The plottings of the corrected mortality rate versus the year and the amount of soluble or insoluble substances showed remarkable correlation. The mortality rate was also analyzed in relation to the degree of atmospheric pollution (SO3 in deposited particulate matter/square root of the amount of precipitation). Using the data obtained during 1960-1969.

18438 APTIC NO. 36072

Sandage, Curtis

TOLERANCE CRITERIA FOR CONTINUOUS INHALATION EXPOSURE TO TOXIC MATERIAL. II. EFFECTS ON ANIMALS OF 90-DAY EXPOSURE TO H2S, METHYL MERCAPTAN, INDOLE, AND A MIXTURE OF H2S, METHYL MERCAPTAN, INDOLE, AND SKATOLE. *Midwest Research Inst., Kansas City, Mo., Air Force Contract AF-33(616)-7055, Proj. 7165, Task 716501, ASD-TR-61-519(II), 30p., Dec. 1961. 23 refs.*

NTIS: AD 287797

Physiological changes in rats, mice, and monkeys were studied during continuous 90-day exposure to controlled atmospheres of toxic vapors and gases. Concentrations of test chemicals were those recognized as Industrial Threshold Limit Values and included hydrogen sulfide (20 ppm), methyl mercaptan (50 ppm), indole (10.5 ppm), and a mixture of these plus skatole (3.5 ppm). Hematologic and urine analyses and liver function tests were performed before exposure and at 30-day intervals thereafter. At the end of the 90-day exposure period, stress tests were conducted prior to autopsy for gross and microscopic pathology. Mortality rates were high only in the group exposed to a mixture of four compounds. There was evidence that animals can adapt to tolerate otherwise lethal concentrations of some of these compounds, and that there are great individual differences in this adaptability. (Author abstract modified)

18439 APTIC NO. 36538

Schmidt, Ferdinand

THE CAUSE FOR CANCER: EXHAUST GAS OR CIGARETTE SMOKE. *(Krebsursache: Abgas oder Tabakrauch). Text in German. Umwelt (Duesseldorf), 1(6):28-30, Dec./Jan. 1971. 15 refs.*

The idea is rebutted that air pollution damages the lung tissue and that cigarette smoke, as an additional factor, may lead to the development of bronchial cancer. There are certain reasons for a rejection of this notion. Lung cancer mortality in the highly industrialized North Rhine Westphalia has the same frequency as in the primarily rural Schleswig-Holstein. Finnland, a country which had practically no industry until World War II and hardly any automobiles, has the second largest cancer mortality of Europe corresponding to the high cigarette consumption. Venice which has hardly any industry and hardly any traffic has a higher cancer mortality than the industrial city of Turin. This again is in agreement with the cigarette consumption. The Seventh Day Adventists who do not smoke for religious reasons but who are exposed to the same air pollution as everybody else, rarely fall prey to lung cancer. Women are less frequently found among lung cancer candidates because they smoke less than men. Los Angeles has the heaviest smog formation in the U. S., caused by the enormous traffic density, but it does not reach the average lung cancer mortality of 200 large American cities.

18440 APTIC NO. 36198

Sherwin, Russell P., T. G. H. Yuen, and Valda Richters

WALL-FREE (L-PHASE VARIANTS OR MYCOPLASMA) ORGANISMS IN THE GUINEA PIG BRONCHUS: ASSOCIATION WITH MICROVILLI OF CILIATED CELLS. *University of Southern California, Los Angeles, Dept of Pathology, Air Pollution Control Office Research Grants AP-00774, AP-00604, and AP-00607-5, 12p., 1971. 9 refs.*

An electron microscopic study of the bronchus of the adult guinea pig has demonstrated the spontaneous occurrence of wall-free organisms consistent with L-phase variants of bacteria or mycoplasma. The intimate relationship to both cilia and microvilli suggests a special life cycle event and a means of protection from bronchial clearance. Since all cultures for mycoplasmas were negative and most of the animals had been fed tetracycline, an L-phase variant identity is favored. The large size of the organisms (500 to over 1000 micron), the presence of ribosomes, and their ultrastructural characteristics in general essentially exclude a viral identity. The possibility of an air pollutant triggering an L-phase variant of Pseudomonas, or other organisms, to revert to the bacterium is being investigated in view of the earlier findings concerning the delayed occurrence of Pseudomonas aeruginosa in tissue cultures of the guinea pig lung. (Author abstract)

18441 APTIC NO. 36200

Sherwin, Russell P., T. G. H. Yuen, and Valda Richters

THE SPONTANEOUS OCCURRENCE OF WALL-FREE ORGANISMS IN THE GUINEA PIG LUNG: ASSOCIATION WITH MICROVILLI AND CILIA. *University of Southern California, Los Angeles, Dept of Pathology, Air Pollution Control Office Research Grants AP 00774, AP 00604, and AP 00607-05, 24 p., 1971. 18 refs.*

The spontaneous occurrence in the guinea pig bronchus of wall-free organisms structurally equivalent to L-phase variants of bacteria or mycoplasmas has been demonstrated by electron microscopy. Since most of the animals had received tetracycline and numerous cultures for mycoplasma were negative, an L-phase variant is favored. On the other hand, L-phase cultures were equivocal due to heavy overgrowth of bacteria, and there is the possibility that special cultural requirements are needed to isolate an unusual type of mycoplasma. The organisms are not believed to be viruses because of their large size, the presence of ribosomes, and the absence of known ultrastructural characteristics of viruses. An unusual variety or L-phase variant of rickettsia, bedsonia, or other organisms cannot be excluded. The intimate relationship to microvilli and to the basilar portion of cilia suggest both a means of extraordinary resistance to bronchial clearance and a special event in its life cycle. That some of the wall-free organisms are L-variants of Pseudomonas aeruginosa has been considered because of the frequent occurrence of Pseudomonas in tissue cultures of the guinea pig lung, especially when the animals have been exposed to nitrogen dioxide and have received tetracycline. The overall findings permit a working hypothesis that an air pollutant may not only impair clearance of bacteria but also trigger L-phase variants of bacteria indigenous to the guinea pig lung to convert to parent organisms. (Author summary modified)

18442 APTIC NO. 36425

Stocks, Percy

LUNG CANCER AND BRONCHITIS IN RELATION TO CIGARETTE SMOKING AND FUEL CONSUMPTION IN TWENTY COUNTRIES. *Brit. J. Prevent. Social Med. (London), vol. 21:181-185, 1967. 12 refs.*

Male death rates from lung cancer at ages 35-44 and 55-64 in 1962- 1963 and male death rates from bronchitis at 55-64 in 1960 were examined from 20 countries. The twenty countries were ranked in descending order of solid fuel consumption in 1955-1958, which ranged from 4129 kg/capita annually in the United Kingdom to 138 kg/capita in Portugal. The cigarettes consumed in the same years ranged from 3422 per adult in the United States to 545 in Norway. The results suggest that while cigarette smoking is the most important factor in determining national death rates of men from lung cancer before age 45, air pollution by coal smoke is as important as cigarette smoking in determining the rates at ages over 55, and that the two factors are sufficient to account for the rate variation in 20 countries, except in Finland, Austria, and the Netherlands where additional unknown factors seem to be operating.

18443 APTIC NO. 36454

Stuart, B. O., Donald H. Willard, and Edwin B. Howard

STUDIES OF INHALED RADON DAUGHTERS, URANIUM ORE DUST, DIESEL EXHAUST, AND CIGARETTE SMOKE IN DOGS AND HAMSTERS. *Battelle Memorial Inst., Richland, Wash., Pacific Northwest Lab., Atomic Energy Commission Contract AT(45-1)-1830, 24p., 1970. 30 refs.*

NTIS: BNWL-SA-3419

A program involving inhalation exposure of experimental animals was undertaken to determine the relative effectiveness of the principal mine air contaminants in the production of pulmonary fibrosis, emphysema, or neoplastic changes. Six groups of 100 hamsters each were exposed in life-span studies for six hours daily to radon daughters, ore dust, and/or diesel exhaust fumes. The possible synergistic action of radon daughters and cigarette smoking in the development of lung cancer in uranium miners is being studied using beagle dogs. Current results are discussed. (Author abstract modified)

18444 APTIC NO. 36278

Swartz, Harry

TOBACCO SMOKE: A NOXIOUS AIR POLLUTANT. A REVIEW (AND COMMENT). PART I. *Rev. Allergy, 25(4):397-405, April 1971. Part II. Ibid., 25(5):490-505, May 1971. 131 refs.*

Even though a great part of tobacco smoke is expelled indoors, it still finds its way to the outside atmosphere through diffusion. The fundamental significance underlying the consideration of tobacco smoke as an important air pollutant is its effect on nonsmokers as well as its exaggerated effect on the smoker. Cigarette smoke contains carbon monoxide and nitrogen dioxide in amounts that expose both smokers and nonsmokers to a toxic hazard. Other toxic agents in cigarette smoke include hydrocyanic acid, acrolein, aldehydes, phenols, and carcinogens. Epidemiologic and physiologic studies have shown that cigarette smoking contributes to the onset and progression of cardiovascular disease, especially to death from coronary disease. Smoking has also been related to peripheral vascular conditions, blood changes, chronic obstructive pulmonary disease, lung cancer, oral cancer, laryngeal cancer, urinary tract cancer, and pancreatic cancer. Tobacco smoking during pregnancy leads to increased prematurity and decreased birth weight. Smoking contributes to periodontal disease and gingivitis, alveolar bone loss, stomatitis nicotina, and may be associated with delayed socket healing and edentulism. The senses of smell, taste, hearing, and sight are also affected by smoking. The synergism between air pollutants and smoking does not involve two separate etiological groupings but variations in concentration and mode of delivery of respiratory irritants to the lungs. (Author abstract)

18445 APTIC NO. 36199

Thomas, H. V., R. L. Stanley, SuzAnne Twiss, and P. K. Mueller

SPUTUM HISTAMINE AND INHALATION TOXICITY. (FINAL REPORT). *California State Dept. of Public Health, Berkeley, Air and Industrial Hygiene Lab., Air Pollution Control Office Research Grant AP 00653, AIHL Rept. 110, 32p., July 1971. 26 refs.*

The histamine content of the lung varies from species to species and, in general, seems to be related to the mast cell content of the tissue. When persons with obstructive pulmonary disease were compared to normal individuals subjected to respiratory irritation by inhalation of nitrogen dioxide, a significant increase was observed in specimen weight in the disease group with no accompanying histamine increase. This resulted in a significantly lower sputum histamine concentration in the disease group. A community survey carried out in the Los Angeles area comparing groups of normal individuals found that sex and age play an important role in the level of histamine in the sputum. The group living in areas where prolonged exposure to high nitrogen dioxide and particulate levels was encountered had the highest histamine concentrations; individuals living in inland areas where oxidant levels were high, but nitrogen dioxide and particulate pollution were in the lower range, did not show elevated levels of histamine. In controlled industrial exposure studies, employees exposed to high toluene diisocyanate levels in the manufacture of urethane foam showed some increase in specimen weight and a significant increase in total histamine with respect to another foam plant with lower TDI levels. Exposure to styrene monomer yielded no difference in histamine concentration between the control and exposure groups. Thus, the findings of this study indicate that sputum histamine analysis is somewhat limited as a screening test for respiratory irritation.

18446 APTIC NO. 36360

Thomson, J. G. and Wallace M. Graves, Jr.

ASBESTOS AS AN URBAN AIR CONTAMINANT. *Arch. Pathol., vol. 81:458-465, May 1966. 5 refs.*

Asbestos bodies were demonstrated in smears from the lung bases in 20% of the females and 30% of the males of 500 consecutive autopsies in subjects of 15 years or over in Miami, Fla. In the great majority of these cases, including all the females, the asbestos bodies were scanty, were not associated with any pulmonary changes, and were regarded as the result of contamination of the urban atmosphere by asbestos. In 6% of all males examined, the asbestos bodies were numerous and were presumably of occupational origin. Both urban air contamination and industrial exposure to asbestos are likely to increase in the future, in view of increasing consumption and diversity of uses of asbestos and asbestos-containing products and of its virtual indestructibility. An increase in the frequency of malignant mesothelioma of pleura and peritoneum is forecast rather than pulmonary disease or disability. (Author summary modified)

18447 APTIC NO. 36411

Vishnevskiy, V. L.

EFFECT OF HYDROGEN FLUORIDE ON INTEGRAL INDICES OF THE CONDITION OF ANIMALS. *(Vliyaniye ftoristogo vodoroda na integral nyye pokazateli sostoyaniya organizma zhivotnykh). Text in Russian. Scientific Research Inst. for Occupational Health and Occupational Diseases, Sverdlovsk (USSR), Flyuoroz Ego Profil., Mater. Simp., 1966, p. 81-89.*

The effect of hydrogen fluoride inhalation on the organism of white rats was studied during their exposure to HF atmosphere in a .1-3.0 mg/cu m concentration for five months for six hours daily. The composition of the peripheral blood of the animals was slightly effected by HF. In all studied cases, the tendency towards decrease in hemoglobin content was observed. The condition of central nervous system under HF inhalation was studied by method of conditioned reflexes and by chronaxymetry. It revealed the prevalence of inhibition of reflexes in the cortex of the large brain and disruption of motoric chronaxy.

18448 APTIC NO. 37180

Weaver, Neill K.

TOXICOLOGIC IMPLICATIONS OF MOTOR GASOLINE AND AUTO EMISSIONS. *Ind. Med., 40(9):31-34, Dec. 1971. (Presented at the American Petroleum Institute, Division of Refining, Midyear Meeting, 36th San Francisco, Calif., May 11-14, 1971.)*

Of the pollutants found in urban air, gasoline and its combustion products contribute significantly to concentrations of carbon monoxide, hydrocarbons, oxides of nitrogen, and particulates, which are composed of lead and other trace elements and compounds. Since none of these contaminants, under ordinary circumstances, reach levels in ambient air which are acutely toxic, concern rests with their possible subacute or chronic effects at relatively low level, long term exposures. The carbon monoxide standard recommended by the American Petroleum Institute is 30 ppm (8-hour maximum); exposure to 30 ppm of CO for 8 hr results in a carboxyhemoglobin level of 5%, a level which is regularly exceeded in cigarette smokers. The standard for nitrogen oxides recommended by API is 0.25 ppm (24 hour maximum), as compared to 0.13 ppm recommended by the Environmental Protection Agency. It is the belief of many experts in the petroleum industry that the need for ambient standards for hydrocarbons and lead compounds has not been demonstrated at the present time. Levels of acute, subacute, and chronic toxicity are also indicated for these compounds, as well as Threshold Limit Values. (Author abstract modified)

18449 APTIC NO. 36102

Woestijne, Karel P. van de and A. Zapletal

THE MAXIMUM EXPIRATORY FLOW-VOLUME CURVE: PEAK FLOW AND EFFORT INDEPENDENT PORTION. *In: Airway Dynamics. Arend Bouhuys (ed.), Springfield, Charles C. Thomas, 1970, Chapt. 5, p.61-72. 11 refs.*

The largest lung volume at which isovolume pressure-flow (IVPF) curves demonstrate a plateau in the course of forced expirations starting from maximum inspiration was determined in nine children and nine adults. This volume, in percentage of vital capacity (VC) or total lung capacity (TLC), is similar in children and adults: a first plateau is reached at an average volume corresponding to 82% of VC or 86% of TLC. In comparision, peak expiratory flow rate (PEFR) is reached at 88% VC or 90% TLC (mean values). These percentages are independent of lung size. In units corrected for lung size, TLC/sec, adults have a lower PEFR and lower maximum flows at the first plateau than children. The resistance of the upstream segment at the first plateau level is relatively smaller in children. To reach that level, children have to accelerate air relatively more than adults for an identical alveolar pressure. At PEFR, the total airway resistance appears to be similar in children as in adults, but children seem to exert a greater effort. However, the presence of flow transients may invalidate the calculation of airway resistance and the comparisons between children and adults at PEFR level. Maximum flow rates on maximum expiratory flow volume curves vary considerably within individuals, even when lung volume history is standardized and when the effect of rapid flow oscillations is removed by statistical curve smoothing. (Author summary modified)

## EFFECTS-PLANTS AND LIVESTOCK

18450 APTIC NO. 36205

Abeles, Frederick B.

THE ROLE OF ETHYLENE IN PLANT GROWTH AND DEVELOPMENT. *Fort Detrick, Frederick, Md., Plant Physiology Div., Proj. 1B562602AD04, Task 02-001 DD1498, Agency Access. DAOL 003, FD Tech. Manu. 623 CMs6711, AMXFD-AE-T 49850, 21p., May 1971. 62 refs.*

NTIS, DDC: AD 724632

Contributions to the study of ethylene as a plan hormone are reviewed. The role of ethylene is mentioned in germination, as well as in bud dormancy, root geotropism, seedling growth, bulb formation, epinasty, motor tissue movement, hook opening, soil levels, flowering, phytogerontological processes, and air pollution. Low levels of ethylene (0.1 ppm) cause plant damage by defoliation, abnormal growth, and loss of blossoms. Economic losses due to plant damage from ethylene are indicated. (Author abstract modified)

18451 APTIC NO. 36258

Allcroft, Ruth

LEAD AS A NUTRITIONAL HAZARD TO FARM LIVESTOCK. IV. DISTRIBUTION OF LEAD IN THE VARIOUS TISSUES OF BOVINES AFTER INGESTION OF VARIOUS LEAD COMPOUNDS. *J. Comp. Pathol., vol. 60:190-207, 1950.*

Blood, tissue, and fecal concentrations of lead in calves after administration of a single large lethal dose of various lead compounds, or after administration of small quantities over long periods, was studied. Ingestion of 0.1 to 0.5 g Pb/kg of body weight resulted in a considerable and rapid rise in the amount of lead on the blood. The high level fell off rapidly at first, but remained elevated for many weeks in animals that survived. Even when fecal lead values had returned to normal, blood values were still abnormally high. When given as the metal or finely ground galena, lead was absorbed to a much greater extent than when given as the dry acetate, the phosphate, the basic carbonate, the oxide, and wet or dry paint. The highest tissue concentrations of lead in calves given large quantities were in the kidney cortex and liver. Small amounts of lead also caused an initial rise in blood lead concentrations followed by a slow fall to a level plateau. The relative tolerance of man and cattle to lead is discussed.

18452 APTIC NO. 36196

Buck, William B.

LEAD AND ORGANIC PESTICIDE POISONINGS IN CATTLE. *J. Am. Vet. Med. Assoc., 156(10):1468-1472, May 15, 1970. 5 refs.*

During each of the past two years, approximately twenty-four episodes of lead poisoning in cattle were documented in the

Veterinary Diagnostic Laboratory of the Iowa State University. The most frequent source of lead was used crankcase oil and machinery grease, both of which may contain high amounts of lead that is apparently readily absorbed via the gastrointestinal system. Other sources include old lead paint, storage batteries, and lead-containing insecticides. In nearly 50% of the episodes, the source of lead was not determined. Accidental incorporation of massive amounts of insecticides in animal feeds has been a primary source of pesticide problems in cattle. Such contamination results not only in the death of animals, but also in the contamination of resulting meat scraps and tankage products used for animal feeds and often accumulation of insecticide residues in the tissues of animals slaughtered for human consumption. Hazardous insecticides prepared in granular and powdered forms for agriculture purposes should be identified by the incorporation of a dye marker or some other readily identifiable material that would be immediately recognizable if it were incorporated in animal feeds. (Author summary modified)

18453 APTIC NO. 36265

Carpenter, Kathleen E.

THE LETHAL ACTION OF SOLUBLE METALLIC SALTS ON FISHES. *Brit. J. Exp. Biol., 4(4):378-390, 1927. 9 refs.*

The lethal action of soluble metallic salts on fishes was examined on the basis of mathematical analysis and physiological experiments. Investigation of the effects of lead salts on fishes determined a survival curve with no theoretical threshold of toxic concentration. The lethal efficacy of the solution varied in inverse proportion to the actual size of the fish and was directly dependent on the absolute quantity of lead salt. The role of the metallic ion in the lethal process was examined. The effective action of lead salts on fishes was purely external in character; the precipitation of an organic lead compound clogged the gills and inhibited their respiratory function, leading to death by suffocation. The effects of soluble salts of zinc, iron, copper, cadmium, and mercury were also studied. (Author summary modified)

18454 APTIC NO. 36140

Davidson, Harold

PINE MORTALITY ALONG MICHIGAN HIGHWAYS. *HortScience, 5(1):12-13, Feb. 1970. 2 refs.*

During the spring and fall of 1966, 3149 pine trees were planted along Michigan highways as part of a highway beautification plan. A 1969 survey of selected plantings indicated that approximately 40% of the pines were dead or in very poor physiological condition. Most of the plants in poor condition were located near the edge of the highway and were in the splash or drift zone. These plants, particularly white and red pine, exhibited considerable needle desiccation as a result of calcium chloride solutions that drifted onto the needles following the application of salt to the highway. Other factors contributing to the loss of trees were the planting of trees with poorly developed root systems and the pruning of fall-planted trees, which resulted in the loss of terminal buds. Loss of trees through salt deposition on crowns can be reduced by planting only species tolerant to salt-injury such as Austrian pine, Scots pine, and spruce.

18455 APTIC NO. 36057

Dunning, John A. and Walter W. Heck

RESPONSE OF PINTO BEAN AND TOBACCO TO OZONE AS CONDITIONED BY LIGHT INTENSITY AND/OR HUMIDITY. *Preprint, Air Pollution Control Office, Raleigh, N. C., Ecology Branch and Agricultural Research Service, Raleigh, N. C., Plant Science Research Div., 29p., 1971. 18 refs.*

The effect of interactions between humidity and light intensity during growth and/or exposure on the response of a sensitive0 plant to ozone was studied. Pinto bean and tobacco were grown using two light intensities (2000 and 4000 ft-c) and two day humidities (60 and 80%). Plants from four combinations of these variables during pre-exposure growth were then each exposed to the same four combinations during expsure to 40 pphm ozone for one hour for a total of 16 treatments. Percent injury to the bean primary leaves and to all tobacco leaves was determined three days after expsure. The results show that the conditions under which plants are grown and exposed have a major influence on the response of the plant to an acute dose of ozone. Changes in sensitivity can be related basically to the effects on stomatal action and the cellular chemistry of the exposed plants. Most changes in sensitivity that occur at time of exposure are probably related to the stomatal apparatus while changes in sensitivity affected by varied growth conditions are more likely due to chemical changes within the plant. A significant interaction between growth light and growth humidity was observed for the pinto bean.

18456 APTIC NO. 36326

Fetner, Robert H.

CHROMOSOME BREAKAGE IN VICIA FABA BY OZONE. *Nature (London), 181(4607):504-505, Feb. 15, 1958. 8 refs.*

Root meristem cells of Vicia faba were exposed to an atmosphere of ozone and the fraction of cells showing chromosome aberrations were recorded. The cells were all exposed in interphase and analyzed at the first anaphase. The results of exposing Vicia faba seeds to 0.4 weight percent ozone for 15, 30, and 60 minutes showed that all chromosome bridges were of the chromosome type. They were the result of dicentric or centric ring aberrations. Also, x-rays were tested and the synergistic effects of ozone and x-rays were measured.

18457 APTIC NO. 36164

Firger, V. V. and T. B. Karpova

EFFECT OF MINERAL NUTRITION ON THE METABOLISM OF CARBON-14 COMPOUNDS AND ON GAS RESISTANCE OF FORAGE PLANTS. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Gas Resistance of Plants with Special Reference to Plant Biochemistry and to the Effects of Mineral Nutrition. M. Y. Nuttonson (ed.), Vol. 9, Silver Spring, Md., American Institute of Crop Ecology, 1971, p. 69-81. 14 refs. Translated from Russian. (Also: Uch. Zap., no. 222:85-97, 1969.)*

Following a 10-second and 5-minute exposure to carbon-14 tagged sulfur dioxide, meadow fescue and timothy showed practically no differences in metabolism of the main groups of organic compounds. Under the influence of fertilizers, during a 5-minute exposure with C(14)02, the polymerization rate of carbohydrates was somewhat higher in the fescue than in the timothy; the percentage of the labeled carbon was higher in the starch and lower in sucrose. Changes in the chemistry of photosynthesis may be attributed both to the indirect effect of fertilizers, to species characteristics, and weather conditions. In the meadow fescue, in the presence of increased solar radiation, improvement in gas resistance under the influence of fertilizers is associated with an increase in synthesis of sugars and a reduction in the synthesis of amino acids and organic acids; in the timothy, on the contrary, an increase in the synthesis of the latter compounds is observed. (Author conclusions modified)

18458 APTIC NO. 36194

Hall, M. A., R. L. Brown, and L. Ordin

INHIBITORY PRODUCTS OF THE ACTION OF PEROXYACETYL NITRATE UPON INDOLE-3-ACETIC ACID. *Phytochemistry, vol. 10:1233-1238, 1971. 13 refs.*

Peroxyacetyl nitrate reacted in vitro with indole-3-acetic acid giving five products, three of which inhibited 2,4-dichlorophenoxyacetic acidtinduced growth of oat coleoptiles. One product was identified as 3-hydroxymethyloxindole. If the products described are formed in vivo from endogenous IAA, the results could offer a partial explanation of the inhibitory effects of PAN upon plants. The action of 3-hydroxymethyloxindole upon plants and bacteria may be attributed to its conversion to 3-methyleneoxindole, a potent inhibitor of sulfydryl groups. (Author abstract modified)

18459 APTIC NO. 36803

Ionescu Al., V. Sanda, Elvira Grou, and Ileana Buiculescu

**CONSIDERATIONS ON THE EFFECTS OF ATMOSPHERE IMPURIFICATION UPON THE FLORA AND VEGETATION OF THE COPSA MICA REGION.** *Rev. Roum. Biol. Ser. Bot., 16(2):125-139, 1971. 15 refs.*

Atmospheric pollution can cause disturbances in vegetation ecosystems and cause damage to the flora of industrial areas. The general condition of plants was surveyed in the Prostita-Copsa Mica area where two sulfuric acid, one non-ferrous, and one carbon black factories are situated. Transpiration was more intense in plants growing in control zones than in polluted areas. Sulfur dioxide, emitted from a non-ferrous metal factory, converted to sulfuric acid on contact with moisture. The acid caused chlorosis and defoliation on some plants. However, other species thrived well, even near sulfuric acid plants. Vines and orchards on the area of the Prostita hill most severely subjected to SO2, have been mostly destroyed. The combined effect of carbon black and SO2 was more powerful than that produced by each element separately. Biochemical transformations of amino acids and proteins were determined in the polluted area. Plant growth, development, and agricultural production were surveyed to determine species sensitivity.

18460 APTIC NO. 36401

Langer, G.

**PARTICLE DEPOSITION AND REENTRAINMENT FROM CONIFEROUS TREES. PART II. EXPERIMENTS WITH INDIVIDUAL LEAVES.** *Kolloid Z. Z. Polym., vol. 204:119-124, 1965. 13 refs.*

The roles of bounce-off, deposit thickness, reentrainment, leaf position, interaction of leaves, and electrostatic forces were investigated. A streamlined-flow-aerosol wind tunnel was used. After particles were removed from the aerosol by the object under study, the particular streamlines involved carry fewer or no particles. The aerosol then flows through a filter of uniform porosity, and the streamlines which are free of particles show as blank areas on the filter surrounded by areas of dust. In the deposition of dust on single leaves of coniferous trees, electrostatic effects were of no significance and did not improve adhesion. Inertial deposition was the controlling parameter, in agreement with the filtration model for single cyclinders. The efficiency of the cedar leaf at 1.30 m/sec for a 2.4 micron surface-diameter dust was 6.0 and 0.5% for the edge and broadside positions respectively. Collection on the back of the wires or leaves due to wake turbulence did not take place. The scale of the turbulence was too small. Bounce-off upon deposition was not observed. Reentrainment did not take place up to the 2.0 m/sec velocity in the 1.8 cm diameter wind tunnel, where boundary layer conditions were much steadier as in the large tunnel. In arrays of leaves a shadowing effect was produced by the forward leaves. (Author conclusions modified)

18461 APTIC NO. 36883

LeBlanc, Fabius, Gilberte Comeau, and D. N. Rao

**FLUORIDE INJURY SYMPTOMS IN EPIPHYTIC LICHENS AND MOSSES.** *Can. J. Botany, 49(9):1691-1698, 1971. 22 refs.*

To study in situ the effects of fluorides on lichens and mosses, lichen and moss-bearing bark discs were cut from trees in an unpolluted area of Arvida, Quebec, and transplanted in groups of six onto trees in an area polluted by an aluminum factory. Fifteen sites, in addition to a control site, were selected in different directions from the factory. At each site, two boards on which the bark discs were fixed were nailed to a tree. One board was removed after four months exposure and the other after 12 months. The lichens and mosses in both control and polluted areas were compared with respect to color, external morphology, plasmolysis in algal cells, loss of green color, nature of reactions toward neutral red and 2,3,5-triphenyl-2H-tetrazolium chloride, absorption spectra of chlorophyll, and fluoride concentrations. Results indicate that fluoride pollution affects moisture balance, causes chlorophyll damage, and produces other symptoms of injury which could lead to the ultimate death of these organisms. At the end of 12 months, lichen fluoride concentrations ranged from 134 ppm at 15 km NE of the factory to 990 ppm at one km E. Moss fluoride concentrations were always lower than lichen concentrations. (Author abstract modified)

18462 APTIC NO. 36197

Mueller, Peter K. and Ronald L. Stanley

**ORIGIN OF LEAD IN SURFACE VEGETATION.** *California State Dept. of Public Health, Berkeley, Air and Industrial Hygiene Lab., National Air Pollution Control Administration Contract 86-68-35, AIHL Rept. 87, 15p., July 1970. 20 refs.*

A model is presented for determining the relationship of airborne lead and soil lead concentrations to lead concentrations in pasture grasses. The major portion of atmospheric lead is derived from combustion of leaded gasoline and from fumes and dusts of industries using lead. Soil may be contaminated with lead by aerial fallout, industrial wastes, pesticides, fertilizers, and agricultural minerals. Soil composition and its acidity are important factors in whether or not lead will be available for plant uptake. On the basis of several published studies, it is concluded that not more than 15 micrograms Pb/g dry weight in forage crops is due to the uptake of lead from soil even at soil lead contents up to about 700 micrograms/g and possibly 3000 micrograms/g. Amounts of lead in herbage substantially greater than 15 micrograms/g are therefore due to aerial fallout. The ratio of lead in herbage to the rate of lead fallout was reported previously as a constant of 50 sq m days/kg herbage. This model was applied to a typical situation in which grass lead content of pastures toxic to horses was greater than about 80 micrograms/g, top soil lead contents averaged about 300 micrograms/g, and the suspended particulate lead concentration averaged about 0.5 micrograms/cu m.

18463 APTIC NO. 36159

Nikolayevskiy, V. S.

**PHYSIOLOGICAL-BIOCHEMICAL PRINCIPLES OF THE GAS RESISTANCE OF PLANTS.** *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Gas Resistance of Plants with Special Reference to Plant Biochemistry and to the Effects of Mineral Nutrition. M. Y. Nuttonson (ed.), Vol. 9, Silver Spring, Md., American Institute of Crop Ecology, 1971, p. 1-27. 126 refs. Translated from Russian. (Also: Uch. Zap., no. 222:5-33, 1969.)*

Principal advances in research pertaining to the gas resistance of plants are reviewed. The influence of toxic compounds on the anatomical-morphological structure of leaves and the physiological-biochemical characteristics of plants is considered. Also, the species of plants resistant to various compounds in different physico-geographical zones have been ascertained. Investigators have undertaken detailed studies of the chemistry of injuries to plants by acid gases, as well as the chemical mechanism of transformation of sulfur dioxide in plants and its influence on the metabolism of carbon compounds, with the aid of isotopic techniques. Considerable attention has been given to the development of methods for studying gas resistance of plants. Of major importance for a successful diagnosis and study of the gas resistance of plants is the establishment of direct indicators characterizing the degree of plant resistance. The effects of ammonia, mercury, acids, fluorine, chlorine, and other pollutants on plants are described.

18464 APTIC NO. 36162

Nikolayevskiy, V. S. and A. G. Miroshnikova

EXPERIENCE IN THE USE OF THE BIOCHEMOLUMINESCENCE METHOD FOR DIAGNOSING THE GAS RESISTANCE OF PLANTS. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Gas Resistance of Plants with Special Reference to Plant Biochemistry and to the Effects of Mineral Nutrition. M. Y. Nuttonson (ed.), Vol. 9, Silver Spring, Md., American Institute of Crop Ecology, 1971. p. 50-53. 3 refs. Translated from Russian. (Also: Materialy Pervoy Ukrainskoy Konferentsii, Kiev, 1968, p. 115-120.)*

The development of a biochemiluminescence method opens up new opportunities for the study of the interpretation of the biochemical aspects of the oxidation processes in plants under the influence of sulfur dioxide. A set of electronic instruments with a high sensitivity photomultiplier were used to record spontaneous and induced oxidation processes. Etiolated plants of forage grasses were more resistant to sulfur dioxide than green plants, requiring concentration 10 times higher than those required for green plants to produce damage. Under the influence of sulfur dioxide, the luminescence in etiolated plants increases. The activity of the luminescence is more pronounced in the resistant species, fescue, and less pronounced in timothy grass. Concentrated sulfur dioxide depresses the luminescence of both species. In etiolated plants there is no relationship between the amount of substances oxidized and the vulnerability of plants to sulfur dioxide. (Author conclusions modified)

18465 APTIC NO. 36163

Nikolayevskiy, V. S. and A. T. Miroshnikova

GAS RESISTANCE AND CERTAIN BIOCHEMICAL CHARACTERISTICS OF ETIOLATED AND GREEN PLANTS OF FORAGE GRASSES. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Gas Resistance of Plants with Special Reference to Plant Biochemistry and to the Effects of Mineral Nutrition. M. Y. Nuttonson (ed.), Vol. 9, Silver Spring, Md., American Institute of Crop Ecology, 1971, p. 54-68. 30 refs. Translated from Russian. (Also: Uch. Zap., no. 222:115-131, 1969.)*

Etiolated and green plants of the meadow fescue and timothy show statistically significant differences in their vulnerability to sulfur dioxide at nearly all ages, thus making it possible to use the biochemiluminescence method for studying the gas resistance of plants. A direct relationship was observed in etiolated and green plants of both species between the amount of oxidizable substances, ascorbic acid, and vulnerability to sulfur dioxide. The degree of influence of sulfur dioxide on the ultrafaint luminescence of plants depends on their age, with the greatest effect observed at the age of greatest physiological activity. Sulfur dioxide causes a luminescence flash which is greater in the meadow fescue than in the timothy. (Author conclusions modified)

18466 APTIC NO. 36165

Nikolayevskiy, V. S., V. V. Firger, and G. A. Vaseva

METABOLISM OF CARBON-14 COMPOUNDS IN FORAGE GRASSES AND THE EFFECT OF SULFUR DIOXIDE ON IT. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Gas Resistance of Plants with Special Reference to Plant Biochemistry and to the Effects of Mineral Nutrition. M. Y. Nuttonson (ed.), Vol. 9, Silver Spring, Md., American Institute of Crop Ecology, 1971, p. 82-91. 18 refs. Translated From Russian. (Also: Uch. Zap., no. 222:57-67, 1969.)*

Forage grasses differing in gas resistance to sulfur dioxide also differ in their content of oxidizable substances and ascorbic acid. Meadow fescue, a resistant species is characterized by a reduced content of oxidizable substances and ascorbic acid. Under the influence of sulfur dioxide, an increase in the content of oxidizable substances is sometimes observed. The meadow fescue as compared with timothy is characterized by a reduced intensity of photosynthesis and a lower rate of absorption of sulfur dioxide. Under the influence of sulfur dioxide, definite changes in the metabolism of carbon in forage plants are observed which are attributable to their gas resistance. (Author conclusions modified)

18467 APTIC NO. 36166

Nikolayevskiy, V. S. and V. V. Suslova

EFFECT OF SULFUR DIOXIDE ON PIGMENTS OF FORAGE GRASS. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Gas Resistance of Plants with Special Reference to Plant Biochemistry and to the Effects of Mineral Nutrition. M. Y. Nuttonson (ed.), Vol. 9, Silver Spring, Md., American Institute of Crop Ecology, 1971, p.92-106. 22 refs. Translated from Russian. (Also: Uch. Zap., no. 222:99-114, 1969.)*

The forage grasses meadow fescue and timothy, which differ in gas resistance to sulfur dioxide, are also markedly different during the tillering stage from the standpoint of the nature of the changes in their vulnerability in relation to gas concentration. The fescue is characterized by an almost directly proportional dependence, and the timothy, by a logarithmic dependence. During the ontogeny of the timothy, regular decrease of gas resistance occurs, and a decrease of the sublethal and lethal sulfur dioxide concentrations results from intensification of the physiological-biochemical processes with the onset of the productive stage. During ontogeny, timothy shows a general increase in the concentration of the pigments without any appreciable change in their proportions. Under the influence of sulfur dioxide, certain differences in the destruction of individual pigment systems are observed in the plant species studied during their tillering stage. Low sulfur dioxide concentrations apparently cause an intensification of the enzymatic oxidation of the pigments, while high sulfur dioxide concentrations, by inactivating the enzymes, cause a stabilization of the content of the pigments. (Author conclusions modified)

18468 APTIC NO. 36218

Przybylski, Z.

RESULTS OF CONSECUTIVE OBSERVATION OF EFFECT OF $SO_2$, $SO_3$ and $H_2SO_4$ GASES AND VAPORS ON TREES, SHRUBS, AND ENTOMOFAUNA OF ORCHARDS IN THE VICINITY OF SULFUR MINES AND SULFUR PROCESSING PLANT IN MACHOW. *(Wyniki kolejnej obserwacji nad dzialaniem gazow i par SO2, SO3 i H2SO4 na drzewa, krzewy i szkodliwa entomofaune sadow w rejoine kopalni i zakladow przetworczych siarki w Machowie k/Tarnobrzega). Text in Polish. Postepy Nauk Roln. (Warsaw), 15(6):131-138, 1968. 1 ref.*

The effects of sulfur dioxide, sulfur trioxide, and sulfuric acid gases and vapors on the ecology of an area near a sulfur processing plant was studied. Harmful changes occurring within a 2-year period were observed on fruit trees, wild trees and shrubs. The most pronounced damage to plants occurred south-east, east, and north of the plant, and damage to trees was observed even 4 km away from the plant. Depending on the species of tree, symptoms of damage include yellowed leaves (apple trees), diminished leaves (pear trees), necrosis of leaf tissue and leaf drop. Fruit yields decreased because fewer bees were present during tree blooming. The occurrence of a new fruit worm more resistant to the effects of sulfur compounds was observed.

**18469** APTIC NO. 36374

Rosinski, J. and C. T. Nagamoto

PARTICLE DEPOSITION ON AND REENTRAINMENT FROM CONIFEROUS TREES. PART I: EXPERIMENTS WITH TREES. *Kolloid Z. Z. Polym., 204(1/2):111-119, July/Aug. 1965. 5 refs.*

In wind tunnel experiments using a fluorescent zinc sulfide tracer, deposition of dry solid particles of two-micron diameter on leaves of Juniperus scopulorum sarg. (red cedar) and Pseudostsuga taxifolia (poir.) Britt. (Douglas fir) was found to follow two different modes, which are dependent on dose. Deposition can be expressed by ln C + k1 equals k2 ln D where C is area coverage, D is dose, and k1 and k2 change values at a dose equal to three to seven times ten to the ninth particles per cross section of a tree. Reentrainment of particles from leaves located in the upwind section of a tree differed appreciably from reentrainment of particles from leaves located in the downwind section. Particles blown off from the upwind part of the tree were deposited on leaves located in the downwind section during the first half hour. The experiments were conducted at four wind speeds: 195, 280, 410, and 710 cm/sec. At 280 cm/sec deposition was maximal and rate of reentrainment was minimal. (Author summary modified) 0

**18470** APTIC NO. 36139

Schenck, N. C.

INCIDENCE OF AIRBORNE FUNGUS SPORES OVER WATERMELON FIELDS IN FLORIDA. *Phytopathology, vol. 58:91-94, Jan. 1968. 8 refs.*

Spore traps were used to estimate the spore numbers of Mycosphaerella citrullina, Pseudoperonospora cubensis, Cercospora spp., and Alternaria spp. over watermelon fields in central Florida during the period 1964-1966. Spores of these fungi were most abundant in June, when watermelon floiage was most extensive and summer rains had begun. Ascospores of Mycosphaerella citrullina were trapped after periods of free moisture throughout the year and in greater numbers than spores of the other fungi. Conidia of Pseudoperonospora cubensis were trapped most abundantly from 6 to 10 am after a dew and occurred only during a period of 30 days in the entire year. Alternaria and Cercospora spores occurred both day and night, but predominated during the day. Alternaria spores were trapped most frequently during periods of high winds, whereas Cercospora spores were trapped most abundantly in the morning hours shortly after the dew dried. (Author abstract)

**18471** APTIC NO. 36153

Spedding, D. J.

UPTAKE OF SULPHUR DIOXIDE BY BARLEY LEAVES AT LOW SULPHUR DIOXIDE CONCENTRATIONS. *Nature (London), vol. 224:1229-1231, Dec. 20, 1969. 16 refs.*

Barley plants at the three-leaf stage were exposed two at a time, to a continuous flow of sulfur-35 sulfur dioxide in a glass tube 30 cm long and five cm in diameter, and total SO2 uptake by the leaves was obtained from their S-35 activity. A pressure porometer was used to determine the degree of opening of the stomata. In the humidity range 80-85%, there is at least a factor of six increase in average deposition velocity for barley leaves with open stomata compared with leaves with closed stomata. The velocity of deposition is discussed, as well as external and internal resistance of the leaf to SO2 uptake.

**18472** APTIC NO. 37170

Ting, Irwin P. and S. K. Mukerji

LEAF ONTOGENY AS A FACTOR IN SUSCEPTIBILITY TO OZONE: AMINO ACID AND CARBOHYDRATE CHANGES DURING EXPANSION. *Am. J. Botony, 58(6):497-504, 1971. 20 refs.*

During their development, cotton leaves pass through a state in which they are highly susceptible to ozone. Ozone fumigation experiments with Gossipium hirsutum L plants in growth chambers showed that the period of maximum ozone susceptibility corresponds to a minimum concentration of soluble sugars and free pool amino acids. Specific amino acids, e.g., aspartate, serine, threonine, glutamate, asparagine, alanine, glycine, valine, isoleucine, leucine, histidine, tryptophan, tended to reach a minimum when plants were maximally sensitive to ozone. After ozone exposure there was a dramatic increase (up to two-fold) in the concentration of most free pool amino acids. Exceptions were phenylelanine, alanine, phosphoserine, phosphoethanolamine, and ethanolamine. Soluble protein decreased following exposure but not to the extent that free pool amino acids increased. Visible evidence of ozone exposure was lead flecking on the upper surface. Evidence that ozone enters the leaf during nonsusceptible, as well as susceptible, periods suggests that ozone damage is due to depletion of soluble reserves (carbohydrates and amino acids). When these reserves are low, oxidized components may not be repaired at a rate sufficient to prevent ultimate leaf necrosis.

**18473** APTIC NO. 36161

Yatsenko, V. M. and V. S. Nikolayevskiy

EFFECTS OF MINERAL NUTRITION ON CERTAIN PHYSIOLOGICAL-BIOCHEMICAL CHARACTERISTICS AND GAS RESISTANCE OF FORAGE GRASSES. *In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Gas Resistance of Plants with Special Reference to Plant Biochemistry and to the Effects of Mineral Nutrition. M. Y. Nuttonson (ed.), Vol. 9, Silver Spring, Md., American Institute of Crop Ecology, 1971, p. 34-49. 20 refs. Translated from Russian. (Also: Uch. Zap., no. 222:69-84, 1969.)*

The feasibility of regulating the gas resistance of plants by means of mineral nutrition was established. Forage grasses exposed to sulfur dioxide were more resistant when treated with nitrogen and potassium. The positive effect of nitrogen is apparently due to its important role in protein metabolism, and that of potassium, to its role in the regulation of the permeability and ionic behavior of the protoplasm. Oxidizability, ascorbic acid, water-holding capacity, and oxidation-reduction potential can be used to indicate species differences in the gas resistance of forage grasses. Under the influence of fertilizers, the change of these indicators does not always coincide with the change in gas resistance. This makes it necessary to postulate that the indicators are connected only indirectly with the mechanism of plant resistance. (Author conclusions modified)

## EFFECTS-MATERIALS

**18474** APTIC NO. 36051

Godfrey, Douglas and Richard L. Courtney

INVESTIGATION OF THE MECHANISM OF EXHAUST VALVE SEAT WEAR IN ENGINES RUN ON UNLEADED GASOLINE. *Preprint, Society of Automotive Engineers, Inc., New York, 16p., 1971. 8 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710356.)*

Valve seat wear or sinkage or recession was observed in eight engines run on unleaded fuel. Detailed studies of valve seat wear were undertaken in a 302-cu in. V-8 engine run for 10.25 hours at wide-open throttle on a dynamometer stand. The seat was oxidized and flaky, and the valve face was spotted with hard oxide nodules. Results indicate that during operation the oxide flakes adhere to the valve face to form nodules which become embedded in the metal. With the embedded nodules, the valve wears the cast iron seat by abrasion. Loads, rotation, and temperatures are often influencing factors. The use of leaded fuel in another engine formed a lead oxide-lead sulfate product on the hot valve face and a Pb (chlorine 0.75-bromine 0.25)2 product on the cooler seat. These compounds are high-temperature solid film lubricants which, by coating the surface, inhibit cast iron oxidation and also prevent material transfer. (Author abstract)

18475 APTIC NO. 36828

Jelgersma J. H. N., A. J. Elshout, and B. van Engelen

INVESTIGATION INTO CORROSION IN THE ELECTRO-FILTERS OF GARBAGE INCINERATION PLANT. *(Onderzoek van de corrosieverschijnselen in de elektrofilters van een vuilverbrandingsinstallatie). Text in Dutch. Polytech. Tijdschr., Ed. Procestechniek (The Hague), 26(24):942-951, 1971.*

Three electrofilters of an incinerator plant were corroded during the first two years of operation even though the maximum exhaust gas temperature was low (260 300 C). Tests were carried out to find the cause of corrosion. Inspection of the deposits and corroded samples from the damaged electrofilters are explained. Results of the chemical analysis indicated that magnesium oxide, chlorine, silicon dioxide, and zinc oxide were present in the deposits. An X-ray examination of the corrosion products showed large quantities of alpha iron oxide and iron chloride. The results of differential thermal analysis of the samples are described with charts, photos, and diagrams. The average composition of gaseous components and their dew point are tabulated. Analysis of exhaust gases is included. Comparative laboratory experiments are described. Graphs of hydrochloric acid formation during stationary and running conditions of the incinerator plant are included. Formation of complex chemical reactions in the corrosion process are described. The recommendations to prevent this type of corrosion, based on the findings, are included.

18476 APTIC NO. 36108

Stickney, P. B. and W. J. Mueller

AIR POLLUTION COSTS AS THEY RELATE TO THE RUBBER INDUSTRY. *Preprint, American Chemical Society, Washington, D. C., Div. of Water, Air and Waste Chemistry, p. 85-92, 1970. (Presented at the American Chemical Society, Division of Water, Air and Waste Chemistry, Chicago, Ill., Sept. 13-18, 1970.)*

Nitrogen oxides, sulfur dioxide, and hydrocarbons have much less effect on rubber products than ozone, so that the major cost of pollution is the cost of protection against ozone. Manufacturing costs include the use of special polymers instead of general purpose ones, protective coatings, the wrappings in which some products such as tires are placed to protect them from ozone before they go into service, and continuing research and development costs. Any meaningful estimate of the cost of atmospheric pollution must include the very important cost of early replacement of rubber products which have failed prematurely. Other costs include labor costs and the replacement of entire subassemblies. The total cost of air pollution as it affects the rubber industry is estimated to be at least $500 million yearly.

18477 APTIC NO. 36804

Zaychenko, V. M., I. I. Rozhnyatovskiy, E. N. Kucheryavyy, D. D. Vorobyev, A. P. Sergeyev, M. S. Komarovskiy, and L. F. Vasyutin

FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL. *(Prichiny nakopleniya korrozionno-agressivnykh komponentov v poglotitelnom masle). Text in Russian. Koks i Khim., no. 5:28-33, 1969. 1 ref.*

Factors contributing to the accumulation of corrosive substances within the recycling oil utilized in the absorption of benzene from coke processing were investigated. Sulfides, cyanides and thiocyanates are absorbed by the recycling oil within the gas exchange facility (absorber) where contact between gaseous and oily phases occurs under increased pressure. The circulating oil contains approximately 50-90 mg/L chloride ion and 110-150 mg/L sulfate ion. Accumulation of aggressive compounds within the absorptive oil is enhanced by chemical reaction occurring under the circumstances. Along with hydrogen sulfide and cyanide, oxygen from coke gas is absorbed as well. This oxygen produces the oxidation of hydrogen sulfide and other sulfides to polysulfides. Polysulfides react readily with cyanide to produce thiocyanates. Decrease in H2S and HCN concentrations within the absorptive oil due to these reactions leads to the absorption of new amounts of sulfides from the coke gas. Increased pressure enhances these processes producing accumulation of corrosive thiocyanates within the recycling oil. To prevent corrosion of the benzene producing equipment, procedures for the removal of H2S before the aromatic hydrocarbon absorption stage should be developed. The countercurrent procedure with alkaline solutions for the capturing of H2S within the absorber section appears to be unsatisfactory for the mentioned purposes.

## EFFECTS-ECONOMIC

18478 APTIC NO. 37179

EARTH - A SPACE SHIP NAMED TITANIC? Qual. Manage. Eng., 11(1):16-18, Jan. 1972.

The critical information gap that exists between professional ecology and industrial actions is pointed out in an interview with Dr. W. J. Beecher, Director, The Chicago Academy of Sciences. Along with others, he feels that industry must become involved in the decisions concerning future sources of power, oxygen, and other gases, as well as usable water. Industry must also share the responsibility for preserving our environment through the control of waste. A political approach through statutory regulation now appears to be the only way to guarantee fair and equal controls which will permit industry-wide cleanup. Industry must learn to emulate nature by learning to recycle industrial wastes. In 1934, Hiram Walker, Peoria, Ill., completed research which permitted the recovery of protein and vitamin-rich residue from the mash by-product which, until then, had been 100% waste.

18479 APTIC NO. 36169

Ayres, Edward

THE ECONOMIC IMPACT OF CONVERSION TO A NONPOLLUTING ATMOSPHERE. *International Research and Technology Corp., Washington, D. C., Department of Transportation Contract PS-01040, Rept. IRT-R-12, 90p., Dec. 30, 1969. 40 refs.*

NTIS: PB 19925

The impact of a changeover in the production of American automotive power plants from the conventional internal combustion engine to a new non-polluting engine would be felt in nearly every sector of the economy. For a few industries -- automotive wholesale and retail trade, automotive repairs and service, engine electrical equipment, petroleum refining, nonferrous metalls, and several others -- the impact would be large. Both lead producers and manufacturers of engine electrical equipment would be faced with severe reductions of sales, but would also discover possibilities for new markets. Some industries would profit from the changeover. The demand for copper, aluminum, stainless steel, and cast iron would probably increase, while the demand for steel would decrease. In general, the longer the period of transition, the smaller the impact. This study has focused on the cost of capital investments required to put the new non-polluting car into production (and the corresponding loss of capital now invested in internal combustion engine plants and equipment), the type of fuel required, the effects of conversion on other industries, and the direct and indirect costs of the final product to the consumer. Cost estimates are based on the introduction of a steam engine.

18480 APTIC NO. 36213

Cowherd, Chatten, Jr.

ECONOMIC EFFECTS OF AIR POLLUTION ON MATERIALS. *Preprint, Missouri Univ., Columbia, Coll. of Engineering, 18p., 1970. 5 refs. (Presented at the Air Pollution Conference, 3rd Annual, Columbia, Mo., Nov. 17, 1970 Paper MRI-1045.)*

Results are reported of a recent study which found that annual economic losses resulting from the soiling and deterioration of materials exposed to polluted atmospheres are far greater than the anticipated yearly expenditures for the control of air pollution. Federal government estimates of control costs (to implement the Air Quality Act) over the next five years total about $7 billion. Losses of more than $9 billion may be incurred each year from increased deterioration of materials; soiling damage to materials may be many times greater. While more data are needed to refine these estimates, present evidence strongly indicates that the control of air pollution is desirable from a purely economic standpoint. (Author summary modified)

18481 APTIC NO. 37181

Kimball, Thomas L.

HIDDEN SAVINGS FROM A CLEANER AMERICA. *Nat. Wildl., 10(2):14-15, Feb.-March 1972.*

The nationwide bill for damages from air and water pollution is estimated at $28.9 billion annually; a reasonable cleanup program will require an investment of $10.2 billion annually. This cleanup will reduce pollution damages by $22.2 billion. Thus, Americans can have cleaner air and water by 1980 and save $12 billion a year at the same time. The average family could save $113/yr with a cleanup campaign that would reduce air pollution damage by 66%.

## STANDARDS AND CRITERIA

18482 APTIC NO. 36087

American Society of Mechanical Engineers, New York, Power Test Codes Individual Committee No. 21 on Dust Separating Apparatus

DUST SEPARATING APPARATUS POWER TEST CODES. *PTC 21-1941, 29p., 1941. 17 refs.*

The test code is designed to cover tests on all types of dust-separating apparatus installed for operation in conjunction with fuel-fired furnaces. The code provides mandatory rules for determining the performance of the apparatus with regard to the overall efficiency of the separator, the efficiency of separation according to particle size, the resistance to gas flow, the dust concentration at the inlet and outlet of the separator, the size analysis of the dust entering, leaving, and caught by the separator, the combustible content of the dust entering, leaving, and caught by the separator, and the quantity of gas passing through the separator. Terms were described and defined. Guiding principles were listed including tolerances, methods of testing, constancy of test conditions, frequency of readings, number and duration and runs, and procedures for operating samplers at fixed point and procedures for operating samplers in continuous traverse of points. Necessary instruments were listed. Equipment includes dust samplers, pitot tubes, metering devices, manometers, thermometers, thermocouples, balance and drying oven, and sieves and sieving machines. The proper computation of the results were illustrated.

18483 APTIC NO. 36175

STANDARD FOR SAFETY. HIGH EFFICIENCY, PARTICULATE, AIR FILTER UNITS. UL 586. *Underwriters Labs., Inc., 1971, 12p.*

A safety and operating standard is presented for high-efficiency, air filter units intended for the removal of very fine particulate matter from the air of industrial and laboratory exhaust and ventilating systems. Sizes, materials, efficiency, test apparatus, and tests are indicated.

18484 APTIC NO. 36346

California Air Resources Board, Sacramento

LEAD. *In: Proposed Revisions of and Addition to the Ambient Air Quality Standards, p. 1, 16-19, Oct. 21, 1970. 7 refs.*

An ambient air quality standard for lead in California is considered for adoption for the first time, as a result of the 1970 annual review of the air quality sections of the State's Health and Safety Code. A maximum of two micrograms/cu m averaged over a 30-day period (and a long-term goal of 1.5 micrograms/cu m averaged over 24 hours) is proposed on the basis of recommendations by the State Department of Public Health because of evidence that at or above such exposures, increased storage of lead will produce detectable metabolic effects. The consequences of such effects are not at present clearly defined but may include a restriction on hemoglobin available to the body for red blood cell functions. Other possible or known effects of high ambient lead levels are noted.

18485 APTIC NO. 36823

Ministry of Health and Welfare (Japan), Dept. of Environmental Health

EMISSION STANDARDS OF STACK GASES (TOXIC MATERIALS) BASED ON THE AIR POLLUTION CONTROL LAW. *(Taiki osen boshiho ni motozuku baien (yugai busshitsu) no haishutsu kijun ni tsuite). Text in Japanese. Taiki Osen Nyusu (Air Pollution News), no. 67:3-39, Nov. 1971.*

Emission standards for various toxic materials in stack gases, based on the Air Pollution Control Law, are presented in tables. Items reviewed are the dust emission standard; average emissions and dust collection rates according to various types of furnaces and various types of dust creating installations; standards and average emissions for settling particles, suspended particulates, chlorine, and fluorides; and the epidemiological study of the influences of fluorides. The Japanese Air Control Law, WHO indexes, Forecast and Warning systems of New York City, the United States National Primary Secondary Ambient Air Quality Standards Federal Register, Air Pollution Emergencies Episode Criteria, and the E.P.A Federal Register are included. Also included in table forms are the records of Tokyo air pollution monitoring stations on suspended particulates; total emission quantity by pollutants and by sources; carbon monoxide saturation of hemoglobin and symptoms; influences on the human body of various toxic matter such as sulfur dioxide, sulfuric acid mist, nitrogen dioxide, ozone, and suspended particulates; nitric oxide and NO2 concentration in Tokyo; emission standards for lead and lead compounds; a review of lead emitting industries; total dust particles and the lead content in the main cities of Japan; lead emission standards in various countries, and the 1969 SO2 measurements in various controlled areas in Japan.

18486 APTIC NO. 37168

Brasser, L. J.

THE PRESENTATION OF MEASUREMENT RESULTS OF AIR POLLUTION CONCENTRATIONS IN RELATION WITH STANDARDS FOR THE RESTRICTION OF THESE CONCENTRATIONS. *(Presentatie van meetuitkomsten van luchtverontreinigingsconcentraties in verband met normen voor de beperking daarven). Text in Dutch. Ingenieur, 84(1):G7-G15, Jan. 1972. 8 refs.*

It is often necessary to compare air quality measurements with air quality standards. When a study involves a network of stations, it is very useful to map the relation between the air quality and the standards. This can be done only when the relation can be expressed in a number for each station. A method is described for expressing the relationship in an index (i.e., sanitation-index). The index is larger than the unit when air quality does not conform to standards and smaller than the unit when pollution is less than the standard allows; it is equal to one when the situation exactly meets the standard.

18487 APTIC NO. 36382

Larsen, Ralph I.

DETERMINING SOURCE REDUCTION NEEDED TO MEET AIR QUALITY STANDARDS. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 60-64. 5 refs. (Oct. 4-7, Paper III/8.)*

The use of standards and pollutant concentration data to determine the source reduction needed to comply with the standards is examined. The techniques consider concentrations as a function of time and space; degrees of pollutant control necessitated by the standards; background concentrations; secondary pollutants; source type; and mathematical models for predicting pollutant concentrations as a function of source strength, location, and meteorology. Concentration of carbon monoxide, nitrogen oxides, nitric oxide, nitrogen dioxide, oxidants, hydrocarbons, sulfur dioxide, lead, particulates, and sulfates are given for several American cities.

18488 APTIC NO. 36519

Ruckelshaus, William D.

ENVIRONMENTAL PROTECTION AGENCY. MOTOR VEHICLE POLLUTION CONTROL. CALIFORNIA STATE STANDARDS. NOTICE OF PUBLIC HEARING. *Federal Register, 37(5):302-303, Jan. 8, 1972.*

A public hearing will be held at the request of the State of California for a waiver of the application of Clean Air Act provisions that prohibit states from adopting standards and test procedures relative to emissions from new model motor vehicles. Prior to March 1966, California adopted standards (other than crankcase emission standards) applicable to control of emissions from 1973-1976 model vehicles. One purpose of the hearing is to determine whether these standards are more stringent than Federal standards.

18489 APTIC NO. 36818

Velds, C. A.

AIR POLLUTION FROM PLUMES, PART 3. PERMISSIBLE CONCENTRATIONS. *Luchtverontreiniging uit schoorsteenpluimen, Deel 3. Toegelaten concentraties). Text in Dutch. Polytech. Tijdschr., Ed. Procestechniek (The Hague), 26(21):831-835, 1971. Part 1, 2, 4-6. Ibid., 26(18):703-709, Sept. 1, 1971; 26(19):742-747, 1971; 26(22):878-885, 1971; 26(23):917-925, 1971; 26(24):952-959, 1971.*

The permissible concentrations applicable for air pollution from plumes are discussed. Different methods exist for expressing the degree of air pollution. The concentration of pollution components of the atmosphere are used to express the degree of air pollution. Conversion of the concentration units is discussed. For example, at 15 C and 760 mm Hg, (n micrograms/cu m) equals (n times 23.6 divided by 1000 M) ppm where M equals Molecular weight. Influence of the sampling time and methods of reporting measurements are described. The following guidelines have previously been given for allowable air pollution: set guides for analysis; air quality goals; air quality standards; emission goals; emission standards; and design standards. The maximum air concentration values and maximum emission concentration values are given and are compared with the Russian standard values. The Russian values are clearly lower (i.e., better) than the American values. This is due to the fact that Russian MAC values are goals while American MAC values are not based on goals. Frequency diagrams, norms of combinations of air pollutants, and emission standards are included.

18490 APTIC NO. 36149

Wood, F. A.

DISCUSSION OF PAPER BY DR. DAINES. *J. Occupational Med., 10(9):524-534, Sept. 1968. 43 refs.*

The paper by Dr. Daines reviewed the effects of sulfur oxides on vegetation. Here air quality criteria and/or standards for SO2 that have been proposed or adopted are evaluated. In establishing criteria and standards, most states and local governments rely mainly on the guidelines set by the National Center for Air Pollution Control. With regard to plant damage, the Center s SO2 guidelines are based principally on field observations and the controlled exposure of one species, alfalfa, to SO2. For several reasons, data based on the correlation of observed vegetable damage with ambient SO2 levels are invalid as a basis for air quality criteria. Many other compounds could be present and, by acting singly or in conjunction with SO2, could result in symptoms. The points at which SO2 is measured and the point at which symptoms are observed are often far removed. A high degree of correlation between SO2 concentration and severity of plant damage does not establish cause and effect. Finally, the effects of microclimatic conditions, i.e., the climate at the plant surface, are ignored. A more accurate basis for the criteria would be the relative sensitivity of a large number of plants in a given locale.

## LEGAL AND ADMINISTRATIVE

18491 APTIC NO. 36329

Western Japan Industrial Pollution Inspection Tour Group

ANTI-POLLUTION POLICY IN WESTERN NATIONS. *(Obei ni okeru kogai taisaku). Text in Japanese. 69p., 1969.*

A group of observers of industrial pollution in the United States, England, France, and West Germany consisting of 15 businessmen, one technical adviser, and two reporters published the results of their month-long tour in September 1969. The general survey emphasizes the difference of philosophy of the East and the West. Western countries have an attitude that anti-pollution policy must be based upon reliable scientific data and established on a long-term, effective treatment by cooperation among the federal and local governments, academies, industries, and ordinary citizens. This is distinctly different from the Japanese short-sighted treatment. The state of anti-air pollution techniques in the West proved disappointing to the group. Western countries too have not yet developed a technique which will cost little and will offer some profit to the system of waste disposal or prevention itself. Not enough research is being done even for such basic problems as cleaning combustion gases or sludges. The actual state of pollution and anti-pollution measures in each country and heavily polluted areas such as Los Angeles, Pittsburgh, New York, Chicago, London, Paris, Ruhr, and the extent of research and technical development in each area are discussed. Impressions and personal gains from this tour are briefly stated by each member of the group at the end of the booklet.

18492 APTIC NO. 36386

Assoc. of Public Health Inspectors (England)

CONTROL OF AIR POLLUTION IN GREAT BRITAIN. *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 262-264. (Oct. 4-7, Paper, VIII/1.)*

The history of legislation to control air pollution in Great Britain is reviewed. Domestic and industrial air pollution control by local authorities and control by the central government are examined. Abatement legislation for smoke nuisances, emissions of chemical pollution, grit, dusts, and sulfur dioxide, smokeless fuel criteria, government grants, control of chimney heights, refuse burning, and laws for power stations, gasworks, and domestic heating are discussed.

18493 APTIC NO. 36509

AIR POLLUTION RAIDS. *APCD (Air Pollut. Control Dist.) Dig., 1(2):3-4, Dec. 15, 1971.*

Surprise, off-hour raids of industrial areas are being conducted by the Los Angeles County Air Pollution Control District. Both ground and airborne units are used in the raids, some of which have involved 3000 plants in a 300-square-mile area. The raids provide information for evaluating present rules and regulations and for determining the nature of future laws required to bring tighter control to air-pollution sources.

18494 APTIC NO. 36543

FEDERAL EMISSION PROTECTION LAW: PROPHYLAXIS CHEAPER AND MORE EFFECTIVE. *(Bundes-Immissionsschutzgesetz: Vorsorge ist billiger und wirkungsvoller). Text in German. R. A. S./Rohr-Armatur-Sanitar-Heinzung, 26(12):686, Dec. 1971.*

For protection against harmful environmental effects by air pollution, noise, vibrations, the procedure of licensing, to which all large air polluters are subject already, shall be speeded up. All medium and small enterprises shall be included. The monitoring of emissions shall be extended and intesified. All new construction has to be planned with a view to the emissions they will cause. Avoidance of them through better construction or different processes should be given priority over cleaning the waste products. All this, plus heavy fines and imprisonment for non-compliance, is demanded by the draft of the Federal Emission Protection Law. The realization of this law would create a uniform basis throughout West Germany for the protection of the environment.

18495 APTIC NO. 36877

Ministry of Health and Welfare (Japan); Ministry of International Trade and Industry; (Japan); Ministry of Transportation, Tokyo Japan; Japan Police Government Headquarters, Tokyo

PREVENTIVE MEASURES OF AIR POLLUTION PRODUCED BY LEAD IN AUTOMOBILE EXHAUST GASES - WITH SPECIAL REFERENCE TO LEAD HAZARDS IN YANAGI-CHO, USHIGOME, AND SHINJUKU-KU. *(Jidosha Haikigasu chu no namari ni yoru taikiosen no boshi taisaku ni tsuite - Shinjuku-ku Ushigome Yanagi-cho engai jiken to kanrenshite). Text in Japanese. 59p., June 1970.*

A liaison conference was organized by four Japanese ministries to consider countermeasures against so-called Yanagi-cho Hazards. A summary report was presented concerning the data of a liaison conference, and countermeasures by each Ministry. Lead quantity exceeded by 60 micrograms, 100 ml the Labor Ministry standard value in the blood of 13 of 62 inhabitants near the Yanagi-cho, Ushigome. A medical group in a consumers co-operative society in the Bunkyo-ku reported that the hazards were due to lead in automobile exhaust gases. An investigation of the cause of the hazards has been carried out by the Ministry of Health and Welfare. The Ministry told the Tokyo Metropolitan Government that preventive measures for automobile exhaust gases should be administered as far as possible. An origin of the hazards was clarified by the result of the medical examinations. Information is given about lead quantity in the blood, urine, and air, and 15 sets of investigation concerning the effect on the human body, and measurement figures of lead in the environmental air. The mean, highest, and lowest value of lead concentrations in the air were classified by locations, the method of determination, and the names of investigation reports. One of the countermeasures by the Ministry of International Trade and Industry was to decrease lead quantity added to the gasoline of automobiles, and to make non-use of lead a long-term project. The problem of a preventive measure of lead hazards by automobile gasoline is being examined by the Ministry of Transportation. The Ministry of Police Administration is striving to consolidate traffic control systems, and to develop a cooperation between traffic control and air pollution monotoring systems.

18496 APTIC NO. 36879

Ministry of International Trade and Industry (Japan) and Okayama Prefecture (Japan)

REPORT ON THE SECOND CONFERENCE ON THE MIZUSHIMA AREA AIR POLLUTION CONTROL. *(Dainiji Mizushima chiku taiki osen boshi taisaku kyogikai chosa hokokusho). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 7(12):709-723, Dec. 1971.*

Okayama prefecture and Kurashiki city formed the Mizushima Area Air Pollution Control Council in Sept. 1967 and began a comprehensive study of the area s air pollution conditions with the general development plan of the coastal industrial complex in the Kurashiki-Mizushima area. A pollution monitoring center was constructed at a central location and the pattern of pollution and transition were studied since then. In spite of the fact that the total emission of sulfur dioxide increased between 1967 and 1971 from 2,751.84 N cu m/hr to 7,981.75 N cu m/hr, the total pollution index has not increased in the area. Up to 1969, high stack emission sources were increased without decreasing the emission amount from low sources, and no improvements had been made on systems at sources. After 1970, collectivization of low emission sources and the use of low-sulfur oil progressed and some measure of pollution control was achieved. As part of the planning for the future development, an air pollution prediction was made upon the projected plan for an area to be newly developed by landfill. Factory layout, possible industrial classifications, production scales, and locations were designed; projected classifications were oil refining, petroleum chemicals, copper refining, aluminum manufacturing, copper wire stretch formation, special steel, glass manufacturing, and shipbuilding. Of these eight industries, three to six were combined, forming four different combinations for simulation tests. Wind tunnel tests were conducted with considerations for seasonal, climatic, fuel, emission gases. If the average sulfur content in fuels is kept under 0.8%, even with the combinations of multi-industries and with the conditions of already functioning industries in the surrounding area, the environmental standard could be maintained.

18497 APTIC NO. 36900

Agency of Scientific Technology (Japan)

THE TREND OF SCIENTIFIC TECHNOLOGICAL DEVELOPMENT AGAINST ENVIRONMENTAL POLLUTION PROBLEMS. *(Kankyo osen mondai ni taisuru kagaku jijutsu katsudo no genjo). Text in Japanese. In: White Paper on Scientific Technology. p. 30-46, 1970.*

The total spending for 1970 toward research projects for environmental pollution control, excluding labor and administration, was approximately $4,480,000. Of the total, 37.8% was spent for air pollution, 27.8% was for water pollution, 29.1% for others, 2.5% for bad odor, and 2.8% for noise and vibration. Private industries with more than $1.6 million capitals (287 industries) spent approximately $36,800,000 in 1969. A breakdown of classifications shows that 15.9% was spent by 14 paper and pulp industries, 9.8% was spent by 12 electric and gas industries, 7.7% was spent by 25 transportation machinery industries, and 6.8% was spent by 23 machine industries. The 1970 goals for the control of sulfur oxides are: desulfurization of stack gas by activated manganese and activated carbon, both with more than 90% efficiency, and the direct desulfurization of crude oil by the suspended catalyst method with 75% desulfurization or less than 1% sulfur content. The goals for automotive exhaust gas control methods are the development of exhaust mainfold reactor, catalytic converter, and exhaust gas recirculation method. They are aimed at the 1975 emission standards of 7 g/km carbon monoxide, 0.3 g/km hydrocarbon, 0.6 g/km nitrogen oxides, and 0.6 g/km particulates.

**18498** **APTIC NO. 37193**

A PREVIEW OF THE YEAR 1972, FEDERAL GOVERNMENT INTENSIFIES ENVIRONMENTAL PROTECTION. *(Ausblick auf das Jahr 1972. Bundesregierung intensiviert Umweltschutz). Text in German. Wasser Luft Betrieb, 15(12):431-433, Dec. 1971.*

The Cabinet of the Federal Government approved a program for the protection of the environment. An advisory panel and an information center concerning all questions of environmental pollution shall be created. For combating air pollution, the Federal Government drafted the Federal Emission Protection Law which calls out for more research and development in the field. It strives to reduce emission of pollutants by Otto engines to one tenth of the average values emitted in 1969. The reduction shall be achieved in steps and shall be completed by 1980. A first step is a limitation of the emission of carbon monoxide and hydrocarbons. A second important step is the law limiting the lead content of gasolines. Other limitations of pollutants found in exhaust gases are in preparation.

**18499** **APTIC NO. 36306**

Aizaki, M., M. Nishida, Y. Yoshimura, H. Ikeda, H. Masuda, T. Nakano, M. Nakao, T. Kimura, H. Hibi, and T. Segawa

AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS. *(Osakashi Nishiyodogawa-ku ni okeru hasseigen taisaku ni tsuite. Sono 1. Gasu funjin taisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):184, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

Out of 330 factories considered to be possible source of pollutant gases, particulates, and odors, 198 factories were investigated by measuring the effluent concentration and the pollutant concentration at the property line. As a result of this investigation, 29 factories were designated to take air pollution control measures. Various dust collectors, filters, scrubbers, electric precipitators, and secondary combustion systems with 99-100% efficiency were installed. The yearly average particulate concentration in Nishiyodogawa-ku was reduced from 0.17 mg/cu m in 1969 to 0.106 mg/cu m in 1970.

**18500** **APTIC NO. 36896**

Clingan, Thomas A., Jr.

ANALYSIS OF IMPORTANT RECENT ENVIRONMENTAL CASES. *J. Air Pollution Control Assoc., 22(1):9-12, Jan. 1972. (Presented at the Air Pollution Control Association, Florida Section, Annual Meeting, Fla., 1971.)*

On the long range, no matter how one is to label the problem, the basic issue concerning the environment is population control and/or the limitation of the mass/energy package each of us carries around. Such problems are outside the scope of the normal duties of courts, and more appropriately in the lap of legislatures. On the shorter scale, we must accept that for the present we do live in such a mass/energy envelope, and we must seek ways to survive within that parameter through the adoption of effective and rational regulations, standards, and controls. This latter exercise involves both courts and legislatures. First, courts, serve as forums in the traditional manner, where one party feels that he has been aggrieved by another and he seeks compensation for his injury, or he wishes to have the force that disturbs him abated, or both. However, where new legislation has become involved in a dispute, it may fall to the court to interpret and clarify the language of that legislation, and, sometimes if there are gaps in the law, to fill them by judicial activism. A few examples of these judicial functions are cited, as well as the interpretation courts have given certain recent legislation. Some of the procedural problems that private citizens may confront in calling upon their government to take action in environmental situations are presented.

**18501** **APTIC NO. 36342**

Croke, E. J., J. J. Roberts, J. E. Ash, C. Chamot, K. G. Croke, A. S. Kennedy, A. S. Cohen, L. A. Conley, J. E. Norco, A. D. Rossin, T. L. Duffy, R. Kasper, J. E. Carson, D. F. Gatz, F. C. Kulhanek, H. Moses, D. M. Nelson, G. A. Zerbe, E. W. Klappenbach, J. W. Lin, D. Parsons, S. G. Booras, J. P. Bradley, R. J. Votruba, and A. Hurter

CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT). *Argonne National Lab., Ill., Center for Environmental Studies; Chicago Dept. of Environmental Control, Ill.; National Air Pollution Control Administration, Raleigh, N. C., Div of Meteorology; and Atomic Energy Commission, Div. of Biology and Medicine, AEC Contract W-31-109-Eng-38, 393p., Feb. 1971. 60 refs.*

NTIS: ANL/ES-CC-009

The Chicago Air Pollution Systems Analysis Program is examined with respect to basic goals, emission inventory, data management, air pollution meteorology, statistical studies of air pollution, atmospheric dispersion models, episode control programs, emission control tests, and air resource management. The major sources of sulfur dioxide emissions were power plants and coal and oil-burning industrial plants; domestic and commercial heating contributed to the total emissions. Meteorological data on pressure gradients, temperatures, stability, anticyclones, stagnation, winds, and inversions and topographic information were correlated with air pollution episodes. Based on field test data and statistical computations, a diffusion model was developed for determinations of plume behavior, mixing-height assumptions, dispersion rate, and effective stack height and correlations with meteorological factors. The design of episode control programs was examined with respect to cost-effectiveness analysis of techniques, natural gas resources, and the development of an allocation model for natural gas. Complete data on operational procedures, field tests, computer programs, SO2 concentrations, and mathematical computations are included.

**18502** **APTIC NO. 36895**

Dickens, Ben H.

TAX-FREE FINANCING OF POLLUTION CONTROL FACILITIES. *J. Air Pollution Control Assoc., 22(1):13-14, Jan. 1972. (Presented at the Air Pollution Control Association, Florida Section, Annual Meeting, Fla., 1971.)*

Recent proposed Internal Revenue Service regulations, published on June 5, 1971 and implementing Section 103 of the Internal Revenue Service Code, provide additional methods for financing pollution control equipment in unlimited amounts through the use of tax exempt industrial development bonds. The Legislature of Florida has recently enacted the Florida Industrial Development Financing Act, which creates the local governmental agencies contemplated by the federal legislation and significantly enlarges the power of local governmental agencies to issue industrial development bonds for pollution control. Any industry desiring to have eligible projects financed under the cited state and federal acts must make an application to the local governmental authority for such financing. All projects must be self-liquidating, and the industry leasing or purchasing the facility is required to pay the necessary reasonable costs related to the issuance of the bonds, including feasibility studies, architects fees, engineers fees, attorneys fees, court costs involved in validating the bonds, and other similar expenditures.

18503 APTIC NO. 36090

Dickerson, W. D.

SENSITIVITY ANALYSIS OF SELECTED AIR QUALITY IMPLEMENTATION PLANNING PROGRAM INPUT PARAMETERS. *TRW Systems Group, McLean, Va., Office of Air Programs Contract PH 22-68-60, 87p., July 1971. 9 refs.*

NTIS: PB 203067

A major problem in the analysis of regional air pollution abatement (control) strategies is the collection and verification of an adequate data base. If computer programs are used, the scope of the data base must be expanded to include effective stack parameters and regional cost data. As an aid in the definition and use of these parameters, their sensitivity, with respect to pollutant concentration value and/or annual device cost are determined. The atmospheric diffusion model and the control cost model of the Air Quality Implementation Program are utilized. A sensitivity analysis of the effective stack height parameters for individual sources is presented, as well as a sensitivity analysis of the regional cost parameters with respect to the annual control cost of each physical device available of the IPP control cost model. Parameters include stability wind rose, mixing height, ambient temperature and pressure, plume rise, exit velocity, and wind velocity. Control devices include scrubbers, centrifugal collectors, electrostatic precipitators, impactors, fabric filters, afterburners, flue gas desulfurization, catalytic oxidation, by-product manufacturing, and limestone injection.

18504 APTIC NO. 36406

Doran, John J.

ELECTRIC POWER - IMPACT ON THE ENVIRONMENT. *Proc. Am. Power Conf., vol 32:1029-1036, April 1970.*

The impact of providing the needed electricity, without unduly affecting the environment, is discussed. Important plant siting criteria for electric power generating stations are cooling water availability, land availability, topography, geology, seismicity, proximity to load, transportation, fuel, meteorology, ecology, land use, air and water emission quality, and appearance. Particular attention is being paid to reduction of nitrogen oxides from power plants. Proposed siting procedures were given. Siting procedures for transmission lines and distribution lines were also presented. California power plants are specifically discussed.

18505 APTIC NO. 36529

Frenzel, J.

MEASURES AIMED AT KEEPING THE AIR CLEAN WITH SPECIAL REGARD TO PRESENT LEGISLATION. - MODEL CASE OF LINZ. *(Massnahmen zur Reinhlatung der Luft im Raume Linz unter Beruecksichtigung der derzeitigen Gesetzssituation). Text in German. Berg- Huettenmaenn. Monatsh., 116(9):304-308, Sept. 1971.*

While there is no Clean Air Act in Austria, pollution control can be enforced with existing legislation. As a result of repeated complaints, the Health Department of the city of Linz began measuring sulfur dioxide and particulate emissions in 1954 by methods used in West Germany. Currently, SO2 is monitored continuously by five Ultragas-3S measuring instruments. Particulates were measured from April 1968 to April 1969, and from August 1969 to August 1970; in the first period on an area of 34 sq km, in the second period on an area of 61 sq km by 50 stations each time. Dust fall was measured in g/sq m per day. If norms in force in West Germany are used as criteria then only 14 sq km (41%) of the area monitored in the first measuring period, and 34 sq km (55%) of the area monitored in the second period qualify as residential areas. The maximum permissible SO2 concentration is being repeatedly exceeded along with other pollutants, especially in summer months. The ratio of SO2 emitted by domestic heating installations to SO2 emitted by industry fluctuates between 1:11 and 1:16; thus industry emits the lion share of SO2. Carbon monoxide and nitrogen oxides are measured occasionally, other pollutants only sporadically. To control pollution, two paragraphs of existing industrial code were invoked and upheld by higher courts. Currently a Health Department representative has a voice in the certification proceedings of new industrial enterprises. Established industries are forced to adopt control measures by the pressure of public opinion.

18506 APTIC NO. 36368

Henderson, J. S.

AIR POLLUTION CONTROL. PART ONE: LAWS AND THEIR IMPACT. *Glass Ind., 51(6):260-263, June 1970. 7 refs.*

The Air Quality Control Act of 1967 provided a procedure for regional air pollution control by state and local agencies. Under the Act, each state is responsible for adopting regional air quality standards and for developing an abatement implementation plan after regional designations are made. To achieve a reduction in ambient air pollution levels, a control agency must adopt and industry may be required to meet, multiple types of air pollution standards including those for source emission, plume visibility, and ambient air quality. For particulate emissions, three code categories apply: fuel burning, process, and incineration. Plume visibility standards apply to plume density of light-obscuring capacity. Representative ambient standards for particulates and sulfur dioxide are summarized. Other requirements and restrictions may include industrial source registration, prohibition of open burning, registration of plant expansions or process changes, construction plan approval by control agencies, routine reports on progress towards air pollution abatement, plant access and inspection by control authorities, provision for stack sampling ports and platforms, and continuous monitoring of stack discharges.

18507 APTIC NO. 36333

Ikejiri, Hiroshi

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 37-38, 1969. (See APTIC 36329.)*

The ratio between industrial profit interest and pollution prevention investment was investigated. The large industries showed a spirit of democracy and a strong consciousness and advertisement of their belief that industries are also part of good citizenry. However, problems are still far from being solved: questions of transformation of energy, overdevelopment of industries, urban population concentration, and traffic congestion are still problems of magnitude, and western countries are still in the state of trial and tribulation. The rapid rate of development of industries and the gross national product in Japan naturally caused many problems, among which the most notable was pollution. Future pollution policies must be considered as part of industrial management policy, backed by the spirit of good citizenry, and built on a good relationship with the local inhabitants. Solid solutions must be sought out on a long-term planning. Industries must exchange technical knowhow with the government and the academic world, actively participating in research and establishing rational basic policies. Once rules are established, they must adhere to the law. The government must understand the realities of industries and establish multi-faceted policies concerning industrial, urban, and traffic pollution on a broad scale.

18508 APTIC NO. 36334

Ishiguro, Hisashi

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 39-40, 1969. (See APTIC 36329.)*

The history of pollution in Europe is a long one: the Alkaline Act of England was passed in 1906; French regulations concerned the unhealthy environment in 1917; and the German civil code concerned disturbance of others in 1869. Therefore, the western spirit of protection of individual privacy and peace is strong. But a large scale, thorough policy against pollution was taken up only 10 or 15 years ago, even in western countries, and the enforcement of regulations seems to have been in effect only for the last few years. Large cities such as Los Angeles, New York, London, and Paris, are still suffering from automobile exhaust gas and incineration and industrial gases. Regulations in the industrial areas are strict, and technical cooperation between industries, civic organizations, and the government seems to be working well. The inspection systems in England and France show a realistic attitude by recommendations of feasible policies and installations of anti-pollution facilities according to individual industry s need and manner of operation. Many facilities have long-term design for water purification. Pittsburgh s city redevelopment, American steel industries anti-pollution measures, the Metropolitan Sanitary District of Chicago, the Greater London Thames water purification plans, the All-French water purification twenty-year plan, English Imperial Chemical Industry s waste water treatment, and West Germany s Bayer Company s community water purification system all have much to offer technically to the designing of water purification systems in Japan.

18509 APTIC NO. 36336

Ishiwatari, Kenji

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 43-44, 1969. (See APTIC 36329.)*

The most important project for Japan during the 1970 s would be a parallel development of economic and scientific techniques with an improvement of human welfare. The western nations are generally emphatic in developing measures for urban rather than industrial pollution problems. This is overt especially in city planning, where residential and industrial areas are clearly separated. This means that urban-type air pollution can be effectively controlled by regulating gas fuels for homes and buildings and automobile exhaust gas. It is noteworthy that New York and London emphasize control of not only SO2, but also of suspended particulates as a part of air pollution control policy. As for control of industrial pollution, western nations seem to be building high stacks; regulations pertaining to SO2 content of gas emission are applicable to individual stacks, and not to factories or industrial complex areas as single units. One great difference between Japan and the west is the ratio of oil consumption by industries. While heavy oil occupies 60% of industrial necessities in Japan, it is only 8% in the U.S. and 30-40% in European countries. The western technology of water pollution control is more advanced than Japan, but the Japanese industrial air-pollution control policy seems more advanced as far as oil industries are concerned; at the same time, this means that Japan has the most difficult problems concerning heavy oil and air pollution.

18510 APTIC NO. 36512

Kirkpatrick, Lane

THE ROLE OF THE STATE AGENCY IN AIR POLLUTION CONTROL. *J. Environ. Health, 34(3):326-328, Nov./Dec. 1971.*

An effective state air-pollution control agency will coordinate all control activities within the state; assume responsibility for proposing statewide legislation, control regulations, and ambient air quality standards; and educate the public to new laws and other control-program impacts. The state agency should also provide assistance to local agencies in program areas where the latter are deficient. For example, local agencies may have insufficient capabilities for general engineering services, stack sampling, meteorological and air-monitoring services, and permit system services. When states provide these services, local agencies can concentrate on enforcement. Another function of the state agency is to determine the allocation of federal funds between state and local agencies based on statewide control priorities.

18511 APTIC NO. 36539

Knoche, Axel

ENVIRONMENTAL PROTECTION IS A CONSTITUTIONAL REQUIREMENT. THE NEW LAW OF THE GERMAN DEMOCRATIC REPUBLIC. *(Umweltschutz ist Verfassungsauftrag. Zum Landeskulturgesetz der DDR). Text in German. Umwelt (Duesseldorf), 1(6):26-27, Dec./Jan. 1971.*

The new law concerning environmental protection which was passed in the German Democratic Republic on May 14, 1970 and which became effective on June 1, 1970 declares that the protection of water, the maintenance of clean air, and the disposal of refuse belong to the duties of government and of society. The law is divided into nine sections. Section six pertains to the maintenance of clean air. The law does not attempt to regulate detailed questions but is limited to outlining basic principles and main tasks. It closes the gaps that existed to date in the fields of air pollution and refuse disposal. No clear answer is provided as to who is to pay for environmental protection.

18512 APTIC NO. 36315

Kondo, Reiichi

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 51, 1969. (SeeAPTIC 36329.)*

Industries in Western nations are making efforts to follow government regulations and to become good neighbors of factory workers and the inhabitants of industrial areas. For instance, the Atlantic Richfield Co. is developing a recirculation system aimed at a 95% reduction of nitric oxide. The Imperial Chemical Industries, Ltd. of England has devised a water treatment method using plastic, making the system an important part of the plant operation. The Bayer Co. of West Germany is constructing a $50,000,000 waste water sewage treatment system in cooperation with the city of Leverkuzen planning to finish it by 1967. Bayer s share in the project is $36,000,000. The sewage water is BOD 15 t/d (380,000 population) and Bayer s waste water is BOD 98 t/d, which at the moment is neutralized and diluted before being poured into the Rhine River. The oxygen concentration of the Thames River has been improved 10-15% recently, and at the moment, the sewage 25 miles below London Bridge is being improved. The appropriate way of pollution treatment would be the propagation of correct scientific and technological knowledge and judgment, and a step-by-step achievement of progress.

18513 APTIC NO. 36313

Kumada, Yasuaki

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti Pollution Policy in Western Nations. (Obei ni oderu kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 45, 1969. (See APTIC 36329.)*

No western country seems to have developed a perfect anti-pollution policy, but each country seems to be making an honest effort and to be adhering to the law. A 70% improvement was made in the atmosphere of London during the past

10 years; still, London s suspended particulates are as high as the worst parts of Tokyo or Osaka. In the United States, the blower noise of plate glass factories is no problem. The competition in the world s economy and the need for a harmonious relationship with the natural and social environment require that Japanese industry develop a technology which is effective in eliminating pollution, yet economically viable.

18514 APTIC NO. 36332

Kurimoto, Junzo

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 35-36, 1969. (See APTIC 36329.)*

In the area of air pollution, none of the western countries (U. S., France, Germany and England) has developed a low-cost desulfurization technique; their answer is the use of natural gas and low-sulfur oil. In Japan, where natural gas is not available and importation of low-sulfur oil is not easy, the government must develop a large-scale desulfurization system worthy of technical export to other countries. The government must also make the import of low-sulfur oil easier. In the area of water pollution, the city of Chicago seemed most active and energetic. Securing drinking and industrial water is a minimum requirement for civil and industrial lives. Technical development for recovery and recycling of cooling water and sewage must be hastened. Solid waste disposal is a difficult and great problem in western countries; but the problem is doubled in Japan where there is no land for disposal of waste. Western countries are carrying out long-term plans step by step, and cooperative work is being conduced covering large areas and many constituents. One example is the Rhine bank where all the countries and industries along the river work together to prevent pollution of the water. Strong community cooperation is regarded as part of anti-pollution measures by large industries. Many civic organizations carry out scientific investigations on pollution, upon which they make legal and tax recommendations to the government. The most impressive aspect of the western attitude toward pollution is its thorough spirit of protection of natural resources and animals and plants, and the democratic spirit of publication of research data and open discussions, which all testify to a well developed code of social ethics.

18515 APTIC NO. 36387

Lagarias, J. S., R. T. Mapston, and L. C. McCabe

THE OPERATION OF THE TECHNICAL COMMITTEES OF THE AIR POLLUTION CONTROL ASSOCIATION (U.S.A.). *International Union of Air Pollution Prevention Associations, Intern. Clean Air Congr. Proc., London, England, 1966, p. 265-267. (Oct. 4-7, Paper VIII/2.)*

The objectives and actions of the Technical Committees of the Air Pollution Control Association of the United States are reviewed. The APCA is composed of municipal, state, and federal authorities; industrial representatives; and university consulting and research personnel. Cooperative operation of these interests is examined. The preparation, flow, and review of reports is shown through final publication in the society journal. Further cooperative actions with other technical societies is described. (Author abstract modified)

18516 APTIC NO. 36132

Lynn, Walter R.

MANAGING THE ENVIRONMENT. *Preprint, Operations Research Society of America, Baltimore, Md., 7p., 1971. (Presented at the Operations Research Society of America, National Meeting, 39th, Dallas, Tex., May 5-7, 1971.)*

A major problem in operations research on environmental questions is identification of acceptable objectives for management strategies. The real challenge to operations research/systems analysis is whether the kinds and quality of information can be provided that will enable those concerned with the establishment of public policy to evaluate specific alternatives and their consequences, including the long and short-run tradeoffs that are involved. The environmental problem is also characterized by external economic effects. Communication problems and reluctance of the academic community to participate in collective efforts are noted

18517 APTIC NO. 36433

McNulty, John W.

STATE TAX INCENTIVES TO FIGHT POLLUTION. *Amer. Bar Assoc. J., vol. 56:747-750, Aug. 1970. 10 refs.*

As of March 1970, at least 31 states had incentive provisions in one or more of their principal revenue producing laws property tax, sales tax, income tax, or franchise tax. A few states are notable for having programmed these incentives into all their principal tax laws, thereby creating the semblance of a comprehensive fiscal orientation toward pollution control. Each states with this legislation has a statutory or administrative procedure prescribing the manner of application by the taxpayer for qualifying the facility as a pollution control facility for tax purposes and the method of determining qualification. It is still too early to arrive at any certain conclusions about the effectiveness of state pollution control tax incentives. Many of the statutes have yet to be implemented by administrative regulation and elucidated by court rulings. Until meaningful regulations are adopted and publicized by the taxing authorities in states having incentive laws, the practical availability of these incentives remains in doubt.

18518 APTIC NO. 36131

Moser, C. E.

AUTOMOTIVE EMISSIONS RESEARCH AND THE COORDINATING RESEARCH COUNCIL PROGRAM. *Preprint, Society of Automotive Engineers, Inc., New York, 4p., 1971. 2 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 11-15, 1971, Paper 710075.)*

The engineering, atmospheric chemistry, and medical projects of the current Coordinating Research Council automotive emissions research program are outlined. The CRC is an organization established by the Society of Automotive Engineers and the American Petroleum Institute, and in the fall of 1967 the Air Pollution Research Advisory Committee was added to the CRC organizational structure. Engineering studies in the CRC-APRAC program are basically structured to determine the interaction of equipment design and fuel composition on vehicle emissions. Twelve medical studies are underway to determine the effect of motor vehicle emissions on health, human performance, and behavior. Atmospheric analysis, haze, diffusion, reactions, and kinetics projects are intended to give better insight into what is happening in the atmosphere, particularly in urban areas.

18519 APTIC NO. 36542

Mueller-Ibold, Klaus

THE EFFECTS OF URBAN DEVELOPMENT AND TRAFFIC ON MAN0 . *(Die Belastungen des Menschen durch Stadtentwicklung und Verkehr0 .). Text in German. Staedtehygiene (Uelzen/Hamburg), 22(11):263-265, Nov. 1971.*

The automobile produces air pollution; an enormous sum is required to eliminate this pollution. International agreements are required in order to do a thorough job. Discussions on the highest level of government are required to outline the goals, which might include the closing of certain areas to traffic entirely. The combustion engine not only pollutes air, but also disturbs the oxygen content. Although measures such as the development of entirely new drives are being taken, the whole approach is moving too sluggishly.

18520 APTIC NO. 36506

Nihei, H. and K. Hishida

CONTROL OF VEHICLE EXHAUST GAS IN THE CASE OF MUNICIPAL GOVERNMENT. *(Chiho jichitai ni okeru jidosha haigasu taisaku). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):241, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The number of registered vehicles in Tokyo was 1,180,000 in 1965 and 2,100,000 in 1970, and is estimated to be 4,140,000 in 1980. The amount of auto exhaust emissions increases with the increase in the number of vehicles. To reduce the amount of carbon monoxide which is estimated to be 1772 ton/day and hydrocarbons which is estimated to be 107 ton/day in 1973 to the level of 1965, various procedures are proposed. To accomplish 55.8% reduction in CO emission and 56.1% reduction in hydrocarbon emission, the concentration limit in idle, installation of exhaust gas reduction device, installation of blow-by gas device, rigid vehicle inspection system, and the reduction of traffic volume are proposed.

18521 APTIC NO. 36448

Plank, R.

THE PROGRESS AND EFFECTS OF SMOKE CONTROL IN LONDON. *Preprint, Greater London Council (England), Research and Intelligence Unit, 25p., Feb. 1970. 16 refs.*

The progress of smoke control on London was evaluated and using a number of readily available indicator, the most important effects of smoke control were estimated. There is evidence that progress in smoke control orders in London is rapid, relative to the progress in the rest of England and Wales, and there is a substantial reduction of smoke in the emission and concentration at ground level. This improvement was achieved at small cost relative to other environmental expenditures. Households and organizations are moving away from coal and changing to smokeless solid fuels, gas, electricity or oil. Mortality and hospital admisssions associated with air pollution decreased, and bronchitis is less frequent. The amount of winter sunshine has increased and the frequency of fog appears to have decreased. The removal of the smoke blanket over London is allowing more sunshine to penetrate to ground level and this is leading to the more effective breaking up of temperature inversions and dispersal of pollution. (Author summary modified)

18522 APTIC NO. 36262

Prinz, B. and H. Stratmann

TERMINOLOGY IN THE FIELD OF AIR TESTING. *(Terminologie auf dem Gebiet der Luftueberwachung). Text in German. Schriftenreihe Landesanstalt Immissions- und Bodennutzungsschutz Landes Nordrhein-Westfalen (Essen), no. 18:75-78, 1970. 6 refs.*

In connection with its air quality measurement program, the province of North Rhine-Westphalia has adopted a terminology which facilitates clear communication and accurate data processing. For example: Area of surveillance is the total area in which the program is being carried out. Test area is the total area covered by a program with particular aims. Measurement station denotes stationary testing, while a measuring point refers to the location of non-stationary measuring, with sampling and measurement equipment only temporarily at the site. Measurement network means the distribution of measuring stations based on a certain system. Density of measurement stations means their number per square kilometer. A random measurement site is a location within a network where a minimum of random samples are being collected; reference measurement site signifies a location where a maximum number of random samples are collected. Measurement time interval is the time between the beginning and end of one measurement or sampling operation, within which all momentary values are beeing integrated, and measurement spacing is the time lapse between two consecutive measurements. Measurement density is the ratio between the sum of all times consumed by measurements and the total time of surveillance. Drive route is the orderly sequence of test locations visited by the survey car during one measuring day. Visiting number is the number assigned to a test location within a drive route. Evaluation area is the area for which a total or partial evaluation is carried out.

18523 APTIC NO. 37163

Sano, U. and K. Hishida

CONTROL OF SULFUR OXIDES IN TOKYO. *(Tokyo-to ni okeru io sankabutsu taisaku ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 6(1):183, 1971. (Presented at the National Council Meeting of Air Pollution Studies, 12th, Nagoya, Japan, Oct. 27-29, 1971.)*

The sulfur oxides pollution prevention plan set by Tokyo Environment Protecting Bureau is outlined. The objective is the reduction in total amount of sulfur oxides emission to the level of 1964, 81,000 ton/year by 1973. Based on the sulfur oxides emission intensity model of 1968, the rate of increase was calculated. The existing method of regulating emission standards according to the stack height is ineffective for the reduction in the total sulfur oxides emissions. The necessary reduction can be achieved only by the fuel regulation, i.e., the reduction in sulfur content in fuels. Accordingly, the new standard of sulfur content in heavy oil is indicated.

18524 APTIC NO. 36318

Shoji, Hikaru

OBSERVING THE POLLUTION PROBLEMS OF WESTERN NATIONS. *(Sogo shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 55-57, 1969. (See APTIC 36329.)*

In western countries, the government establishes a goal for environmental improvement and gives economical and technical assistance to local administrative bodies. Details of actual control are determined according to the needs of a specific locality by its administrative body. Pollution is basically a problem of each local area, and the solution must come from the standpoint of protection of individual health and welfare, then extend to the self-governing of the entire area consisting of the individuals; this administration and legislative procedures must reflect the will of the local inhabitants. This is one marked difference between western nations and Japan, where all the power is held by the central government. In the United States, research and development of techniques are emphasized and education and training of administrators in charge of pollution control is thorough. Japan can adopt many things from the examples of western pollution administration. But the lack of public funds for social welfare has to be solved first. Japan is also faced with the inevitable shortage of land. The park area per person in New York is 19.0 sq m, 10.0 in London, 1.5 in Paris, 8.2 in Duesseldorf, and 1.33 in Osaka. Road ratio is 43% in Washington, 35% in New York, 25% in Paris, 23% in London, and 9.3% in Osaka. To add to these problems, Japanese industries avoid taking responsibility for the pollution they cause. In western countries, industries themselves are deeply engaged in the research and solution of pollution problems. But industries do not blindly follow the wishes of administrative bodies. In order to claim their positions rationally and in order to participate in formation of legislation, they study problems scientifically, supporting civic organizations made of specialists and technicians. Japanese anti-pollution movements among the public are often politically motivated; western movements are usually motivated by love of nature and living things. The reason may be that the Japanese people s will and wishes do not reach the government level by democratic procedure, and therefore they turn the pollution issue into a political issue.

**18525** APTIC NO. 36390

Stockman, Robert L.

AIR POLLUTION CONTROL IN WASHINGTON – PROSPECTS AND NEEDS. *Washington State Univ., Pullman, Proc. Pacific Northwest Ind. Waste Conf., 10th, Pullman, Wash., 1961, p. 3-11. 5 refs. (May 25-26.)*

Goals in air pollution control for the State of Washington are listed, as well as research and development needs. A plan has been outlined and budgetary estimates made in order to establish a state wide basic air sampling network, develop air quality standards, conduct community surveys, provide technical assistance to communities, develop laboratory resources, contact new industries regarding proposed installations, and provide information, education, and training. The organization and functions of the state air pollution control program is discussed.

**18526** APTIC NO. 36030

Uchida, Sanichiro

UNLEADED GASOLINE PROBLEMS. *(Gasorin no muenka ni tsuite no mondaiten). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 50(534):768-777, Oct. 1971. 20 refs.*

In Japan, all the lead additives in both regular and premium gasolines are to be removed by April 1, 1974. This will not only have a considerable influence on the refineries both technically and economically, but will also pose many problems for the automobile manufacturers and users of the cars. With regard to petroleum refining, there will be a problem of how to select a suitable octane booster in order to manufacture a well balanced unleaded gasoline. Valve seat recession and knocking troubles will be present in older cars without new devices.

## SOCIAL ASPECTS

**18527** APTIC NO. 36180

Colorado State Univ, Fort Collins, Coll. of Engineering

COMMENTS BY STUDENTS ON ENVIRONMENTAL ENGINEERING SEMINAR HELD DURING SPRING 1970. *34p., Aug. 1970.*

During the spring of 1970, the College of Engineering at Colorado State University offered an environmental engineering seminar to acquaint graduate engineering students with national and state environmental problems and to stimulate interest in environmental engineering as a career. Four papers summarizing student impressions of the seminar and conveying conclusions for the future are presented. The paper cover such topics as water pollution, air pollution, soil pollution, environmental health, diffusion models, and the training of environmental scientists.

**18528** APTIC NO. 36457

Boote, R. E.

CONSERVATION: (A) MAN AND ENVIRONMENT. *Nat. Soc. Clean Air, Proc. Ann. Conf., p. 34-35, 1970. (Presented at the National Society for Clean Air, Annual Conference, Southport, England, Oct. 20-23, 1970.)*

The quality of the environment is vital for biological and economic survival and for the quality of life. The most difficult social task may be to reconcile economic growth, the carrying capacity of the environment, and human rights and freedoms. Management of the environment is now a primary responsibility, since anything put into the environment that does not occur there naturally or that cannot be disposed of naturally demands management. Pollution often represents a failure to place known economic costs into the price of the product, leaving the public to clean up the after-effects. A revolution in attitudes is necessary to recognize the unity of the living world.

**18529** APTIC NO. 36154

MacKenzie, Vernon G.

NEW STEPS TO MINIMIZE THE HAZARDS OF AIR POLLUTION – FOR PUBLIC AND VOLUNTARY AGENCIES: FOR THE DOCTOR AND HIS PATIENT. *Am. J. Public Health, 54(1):79-83, Jan. 1964.*

While the strengthening of the federal air pollution program would undoubtedly contribute significantly in the efforts to control air pollution, of even greater importance nationally is the need to establish state and local regulatory control programs, and to improve and extend many existing control programs. The control of air pollution is uniquely a community function. There is a great need to inform the public about the facts of air pollution control. The American Medical Association has established a Department of Environmental Health, and the individual medical practitioner can be of significant influence, not only through his medical association and local society, but also by his personal influence on the public and the community.

**18530** APTIC NO. 36314

Muto, Konosuke

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 46, 1969. (See APTIC 36329.)*

There is a lack of public morality and social responsibility on the part of Japanese citizens which is also manifested on the part of industries. But the role of an individual citizen and his awareness as a citizen is directly related to the problem of urban-type pollution. Re-education of individuals as members of the society must be considered as a soluton of this problem. Pollution is by nature strongly local and is determined by geographical, climatical, social, and economical factors of a given area. Therefore, policies must be developed according to particular local needs. Japan is especially in a disadvantageous position due to her great population packed in a small area. However, it has the advantage of not having complex problems such as countries sharing the problems of the Rhine water. Japanese pollution policy in the future must be based on the realities of Japan, backed by individual awareness of public morality, and worked out by cooperation of the government, local public organizations, and industries.

**18531** APTIC NO. 36316

Noda, Shinichi

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 52, 1969. (See APTIC 36329.)*

American pollution control regulations and the manner of enforcement are based on the people's needs which is quite different from the Japanese bureaucratic way of arbitraily passing and enforcing a law. In the U. S., regulations are made by recommendations of specialists after hearing opinions of industrial management. Citizen movements seem to come from objective judgment for need of improvement rather than paranoic hysteria without examining the nature of pollution. In other words, a deeper understanding of democracy manifests itself among the citizens of the United States. Another enviable factor in the U. S. is her large space. Industrial solid waste is not as great a problem as it is in Japan, since it can be buried in the desert a few miles away from the factory. Carbon monoxide can be avoided by driving 20 minutes out of the city.

*18532* *APTIC NO. 36337*

*Takeo, Keinosuke*

*IMPRESSIONS. (Danin shokan). Text in Japanese. In: Anti-Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 49-50, 1969. (See APTIC 36329.)*

In spite of the change in the ratio of air pollution caused by industry and car exhaust gas (from 40%:60% in 1945 to 10%:90% in 1969 in the Los Angeles area), the citizens feelings are still strongly anti-industry. In Pittsburgh, improvements are being made by the Mellon Foundation of the steel industries, and the citizens have become more lenient toward the factories. However, much effort will be wasted in anti-pollution measures unless serious attempts are made on the part of industries to improve their relationship with local citizens. At the University of North Carolina, Raleigh, School of Public Health, authorities in industrial hygiene gave talks concerning history, background, and statistics in pollution. The Research Triangle Institute consists of universities in Raleigh, Chapel Hill, and Durham and the Institute of Air Pollution Training; the area is the training center for the entire U. S. Free training was given to 2100 people in 66 two-week courses in 1968; 65% of the participants constituted state and local government officials, 16% industrial personnel, and the remainder college professors, students, and the general public. Eighteen specialists, and 200 guest speakers were engaged in these lectures, using television, slides, and motion pictures.

## GENERAL

18533 APTIC NO. 36091

Carman, P. C.

THE NEW CHALLENGE TO CHEMISTRY: POLLUTION. *S. Afr. Chem. Proc. (Capetown), 5(5):106-110, Oct./Nov. 1970.*

Ecologic damage from modern technology is discussed. Dichlorodiphenyl-trichloro-ethane (DDT) and a whole group of other chlorinated pesticides are very stable compounds, with the result that extensive applications have created many unwanted effects. In a well-cited case, application of 1/2 lb DDT per acre of forest in New Brunswick, Canada, to control spruce budworm, has resulted in the DDT being washed by rain into a nearby salmon river, wiping out almost the entire year s production of young salmon. Obviously, preference in the future will be given to pesticides which are more easily decomposed than organo-chloro compounds and to alternative methods of control. The chemists contribution lies in the field of pheromones, a general term for a group of substances which have a specific influence in the life cycle of insects. It is calculated that, if the present trend in the United States is followed to 2000 A.D., power plants of all kinds will produce enough annual heat to raise the temperature of the total annual water flow by 20 C. If half the power is derived from fossil fuels, 8.75 billion tons of carbon dioxide, will be discharged into the atmosphere; the other half, from nuclear fuels, could raise the radiation background by 2%. Dust effects on the atmosphere, oxygen balances, the effect of catalytic afterburners, diesel vehicles, and mercury poisoning are also noted.

18534 APTIC NO. 36312

Ishihara, Yoshiji

IMPRESSIONS. *(Danin shokan). Text in Japanese. In: Anti Pollution Policy in Western Nations. (Obei ni okeru kogai taisaku). Western Japan Industrial Pollution Inspection Tour Group, p. 47, 1969. (See APTIC 36329.)*

A carbide factory of the Air Reduction Company Inc. was forced to take improvement measures as a result of petition signed by 1200 inhabitants of the area. After an intervention by politicans and legal authorities, the company decided to combine seven small furnaces into one large one, accomplishing improvement in production and prevention of pollution at the same time. As a result, the plant became a pollution-control model factory in the United States. The advancement of water pollution technology in the west was also impressive. The Imperial Chemical Industries, Ltd. in England, for instance, has developed a special water purification system. However, technology in desulfurization or purification of exhaust gas is still undeveloped, and Japan is in a position to lead other nations in this area. However, the reason for the Japanese advancement of certain anti-pollution technology is her most serious, desperate need for control of pollution problems.

18535 APTIC NO. 36816

Velds, C. A.

AIR POLLUTION BY PLUMES, PART 6. REQUIRED STACK DIMENSIONS. *(Luchtverontreiniging uit schoorsteenpluimen, Deel 6. Vereiste schoorsteenafmetingen). Text in Dutch. Polytech. Tijdschr, Ed. Procestechniek (The Hague), 26(24):952-959, 1971. 44 refs. Parts 1-5. Ibid., 26(18):703-709, Sept. 1, 1971; 26(19):742-747, 1971; 26(21):831-835, 1971; 26(22):878-885, 1971; 26(23):917-925, 1971.*

Nomograms and charts are presented to calculate the height and diameter of stacks. Formulae of Sutton and Holland to calculate chimney heights are presented. Five types of locations of chimneys are described. Empirical relations and formulae are presented along with numerical examples of their application in practice. The improvements required of existing installations are analyzed. The changes required due to throwout, temperature of exhaust gas, chimney height, and chimney diameter are described. Technical and economic implications of these changes are explained. The government and municipal authorities which issue a permit to new industries are described. A list of available advisory institutes and laboratories is included.

# SUBJECT INDEX

## A

ABATEMENT
17911, 17936, 17939, 17942, 17962, 17971, 18113, 18222, 18224, 18277, 18478, 18481, 18491, 18492, 18493, 18494, 18495, 18496, 18500, 18502, 18503, 18505, 18506, 18507, 18508, 18509, 18512, 18513, 18514, 18517, 18519, 18524, 18525, 18528, 18530, 18531, 18533, 17964

ABSORPTION
18010, 18018, 18027, 18036, 18040, 18077, 18099, 18129, 18158, 18170, 18171, 18177, 18284, 18405, 18466, 18477

ABSORPTION (GENERAL)
17945, 17989, 17991, 18069, 18070, 18074, 18080, 18083, 18084, 18115

ACENAPHTHALENES
17928

ACETALDEHYDE
18269

ACETIC ACID
17912, 18458

ACETONE
18027, 18428

ACETYLENES
18077

ACID SMUTS
18085

ACROLEIN
17912, 18444

ACUTE
18384, 18392, 18398, 18411, 18412, 18418, 18424, 18431, 18435, 18448, 18451

ADAPTATION
18411, 18438

ADSORPTION
18001, 18039, 18054, 18068, 18077, 18110, 18125, 18170

ADSORPTION (GENERAL)
18084, 18105, 18497

ADVISORY SERVICES
17990, 18498, 18510, 18525, 18535

AERODYNAMICS
17918, 18094, 18283, 18323, 18360

AEROSOL GENERATORS
17927, 18119, 18128, 18157, 18334, 18364

AEROSOLS
17924, 18016, 18095, 18119, 18128, 18130, 18136, 18157, 18160, 18188, 18211, 18248, 18284, 18285, 18288, 18298, 18312, 18331, 18334, 18341, 18353, 18354, 18364, 18365, 18373, 18378, 18381, 18391, 18407, 18412, 18435, 18460

AFRICA
17936, 18093, 18420, 18533

AFTERBURNERS
17926, 17958, 17960, 17992, 18003, 18023, 18031, 18037, 18041, 18047, 18050, 18052, 18055, 18061, 18071, 18079, 18112, 18183, 18497, 18499, 18503, 18533

AIR CONDITIONING EQUIPMENT
18090, 18111, 18215

AIR POLLUTION EPISODES
18221, 18261, 18291, 18300, 18320, 18354, 18400, 18407, 18418, 18452, 18485, 18501

AIR POLLUTION FORECASTING
18209, 18224, 18277, 18281, 18293, 18304, 18310, 18314, 18315, 18316, 18321, 18324, 18344, 18487

AIR QUALITY CRITERIA
17909, 18485, 18490, 18505

AIR QUALITY MEASUREMENT PROGRAMS
17911, 17942, 18218, 18219, 18221, 18222, 18223, 18224, 18225, 15226, 18227, 18228, 18230, 18231, 18232, 18236, 18237, 18248, 18249, 18257, 18260, 18261, 18264, 18265, 18266, 18267, 18268, 18271, 18274, 18275, 18276, 18306, 18307, 18385, 18485, 18486, 18493, 18494, 18496, 18499, 18505, 18522, 18525

AIR QUALITY STANDARDS
17912, 17948, 17961, 17968, 18111, 18183, 18209, 18215, 18218, 18220, 18221, 18232, 18261, 18383, 18402, 18407, 18448, 18484, 18485, 18486, 18487, 18489, 18490, 18496, 18505, 18506

AIR RESOURCE MANAGEMENT
17909, 18281, 18307, 18478, 18481, 18501, 18503, 18516

AIR-FUEL RATIO
17946, 17983, 17999, 18023, 18047, 18050, 18055, 18057, 18058, 18067, 18075, 18079, 18113, 18152, 18203

AIRCRAFT
17944, 17972, 18014, 18173, 18305, 18311, 18360

ALCOHOLS
17912, 17948, 18069, 18117, 18169, 18444

ALDEHYDES
17912, 17977, 18077, 18192, 18249, 18269, 18382, 18444

ALERTS
18221, 18261, 18354, 18485

ALFALFA
18490

ALKALINE ADDITIVES
17945, 17982, 17989, 18021, 18029, 18059, 18070, 18074, 18080, 18083, 18084, 18105, 18503

ALLERGIES
18407, 18424

ALUMINUM
18005, 18379, 18461, 18496

ALUMINUM COMPOUNDS
17991, 18026, 18272

ALUMINUM OXIDES
18083, 18114

ALUMINUM SILICATES
18026

ALVEOLI
18407, 18440, 18441

AMINES
18065, 18134, 18269

AMINO ACIDS
18396, 18398, 18457, 18459, 18472

AMMONIA
17983, 18021, 18047, 18063, 18072, 18084, 18085, 18105, 18169, 18171, 18258, 18269, 18275, 18463

AMMONIUM CHLORIDE
18072

AMMONIUM COMPOUNDS
17975, 17983, 18021, 18047, 18063, 18070, 18072, 18084, 18085, 18105, 18169, 18171, 18258, 18269, 18275, 18463

ANEMIA
18387, 18393

ANEMOMETERS
18326

ANIMALS
17906, 17912, 17950, 18218, 18391, 18392, 18394, 18395, 18402, 18408, 18409, 18413, 18414, 18416, 18417, 18420, 18421, 18422, 18432, 18433, 18435, 18438, 18440, 18441, 18443, 18447, 18451, 18452, 18453, 18462, 18468

ANTHRACENES
17928, 18135, 18234, 18255, 18380

ANTICYCLONES
18501

ANTIDOTES
18396, 18398

ANTIMONY COMPOUNDS
18272

AREA SURVEYS
17911, 17942, 18219, 18221, 18222, 18223, 18224, 18225, 18226, 18227, 18228, 18232, 18236, 18237, 18248, 18249, 18257, 18260, 18261, 18264, 18265, 18266, 18267, 18268, 18271, 18274, 18275, 18306, 18385, 18496, 18505

AROMATIC HYDROCARBONS
17943, 17953, 17970, 18027, 18049, 18068, 18117, 18145, 18212, 18244, 18258, 18377, 18380, 18382, 18445, 18477

ARSENIC COMPOUNDS
18105

ASBESTOS
17936, 18389, 18420, 18446

ASHES
18082, 18220

**ASIA**
17911, 17914, 17933, 17935, 17938, 17939, 17941, 17949, 17957, 17968, 17972, 17973, 17974, 17980, 17981, 17991, 18031, 18037, 18044, 18049, 18052, 18054, 18058, 18063, 18064, 18065, 18066, 18067, 18070, 18073, 18075, 18076, 18084, 18085, 18090, 18091, 18099, 18104, 18107, 18110, 18111, 18112, 18113, 18114, 18126, 18139, 18140, 18141, 18146, 18147, 18148, 18149, 18150, 18156, 18158, 18159, 18162, 18163, 18167, 18168, 18170, 18171, 18175, 18176, 18177, 18178, 18180, 18182, 18184, 18185, 18186, 18187, 18188, 18193, 18201, 18202, 18205, 18206, 18207, 18208, 18210, 18214, 18215, 18217, 18220, 18221, 18222, 18223, 18224, 18225, 18226, 18227, 18228, 18235, 18237, 18242, 18243, 18244, 18245, 18246, 18247, 18249, 18250, 18251, 18252, 18253, 18255, 18258, 18259, 18262, 18263, 18264, 18267, 18268, 18269, 18270, 18272, 18273, 18274, 18275, 18283, 18287, 18301, 18302, 18303, 18304, 18306, 18307, 18313, 18314, 18315, 18316, 18317, 18318, 18320, 18321, 18322, 18324, 18333, 18334, 18335, 18336, 18337, 18338, 18339, 18340, 18343, 18344, 18348, 18350, 18351, 18352, 18353, 18364, 18368, 18369, 18382, 18383, 18384, 18385, 18423, 18424, 18437, 18485, 18491, 18495, 18496, 18497, 18499, 18507, 18508, 18509, 18512, 18513, 18514, 18520, 18523, 18524, 18526, 18530, 18531, 18532, 17964

**ASPHALT**
17911, 17976

**ASPIRATORS**
18035, 18173, 18254

**ASTHMA**
18354, 18384, 18407, 18418, 18424, 18437

**ATMOSPHERIC MOVEMENTS**
18046, 18054, 18066, 18123, 18150, 18186, 18221, 18225, 18226, 18236, 18237, 18238, 18239, 18240, 18242, 18247, 18256, 18264, 18265, 18274, 18275, 18280, 18281, 18283, 18287, 18288, 18290, 18293, 18295, 18297, 18303, 18310, 18313, 18315, 18316, 18317, 18319, 18320, 18323, 18324, 18328, 18329, 18330, 18332, 18335, 18336, 18337, 18338, 18339, 18340, 18342, 18343, 18345, 18347, 18348, 18349, 18350, 18352, 18353, 18354, 18469, 18501, 18503

**ATMOSPHERIC PHENOMENA**
17908, 17909, 17911, 17912, 17924, 17936, 17939, 17942, 17962, 17979, 18011, 18012, 18020, 18045, 18046, 18054, 18066, 18085, 18101, 18102, 18111, 18119, 18123, 18124, 18125, 18128, 18150, 18152, 18160, 18167, 18172, 18186, 18209, 18211, 18215, 18218, 18220, 18221, 18223, 18224, 18225, 18226, 18228, 18229, 18234, 18235, 18236, 18237, 18238, 18239, 18240, 18242, 18243, 18247, 18254, 18256, 18256, 18261, 18264, 18265, 18269, 18271, 18273, 18274, 18275, 18276, 18277, 18278, 18279, 18280, 18281, 18282, 18283, 18284, 18285, 18286, 18287, 18288, 18289, 18290, 18291, 18292, 18292, 18293, 18294, 18294, 18295, 18296, 18297, 18298, 18299, 18300, 18302, 18303, 18304, 18305, 18305, 18306, 18307, 18308, 18309, 18310, 18311, 18312, 18313, 18314, 18315, 18316, 18317, 18317, 18318, 18319, 18320, 18321, 18322, 18323, 18324, 18325, 18327, 18328, 18328, 18329, 18330, 18331, 18331, 18332, 18333, 18334, 18335, 18336, 18337, 18338, 18339, 18340, 18341, 18341, 18342, 18343, 18344, 18345, 18346, 18347, 18347, 18348, 18349, 18350, 18351, 18352, 18353, 18354, 18356, 18357, 18362, 18373, 18375, 18381, 18386, 18389, 18400, 18401, 18410, 18418, 18419, 18431, 18455, 18460, 18462, 18469, 18470, 18471, 18475, 18487, 18490, 18521, 18501, 18503, 18504, 18518, 18527, 18533

**AUSTRALIA**
17971, 18019, 18021

**AUTOMATIC METHODS**
17972, 18111, 18140, 18178, 18180, 18187, 18199, 18215, 18227

**AUTOMOBILES**
17908, 17913, 17917, 17923, 17931, 17935, 17936, 17941, 17953, 17958, 17975, 17983, 18014, 18024, 18042, 18058, 18067, 18071, 18123, 18133, 18203, 18224, 18235, 18259, 18263, 18270, 18274, 18288, 18290, 18295, 18307, 18391, 18439, 18479, 18508, 18509, 18519, 18520, 18526, 18531, 18532

**AUTOMOTIVE EMISSION CONTROL**
17917, 17920, 17923, 17926, 17932, 17937, 17942, 17946, 17953, 17956, 17958, 17960, 17967, 17969, 17975, 17983, 17994, 17995, 17999, 18003, 18014, 18023, 18024, 18031, 18033, 18036, 18039, 18042, 18047, 18050, 18052, 18055, 18056, 18057, 18058, 18067, 18071, 18075, 18079, 18104, 18112, 18113, 18152, 18156, 18183, 18203, 18233, 18362, 18479, 18497, 18498, 18518, 18519, 18520, 18526

**AUTOMOTIVE EMISSIONS**
17908, 17917, 17920, 17925, 17926, 17932, 17933, 17934, 17935, 17937, 17939, 17942, 17946, 17958, 17959, 17961, 17967, 17969, 17970, 17975, 17976, 17977, 17979, 17983, 17994, 17999, 18014, 18023, 18031, 18033, 18036, 18037, 18042, 18047, 18050, 18052, 18056, 18057, 18058, 18067, 18071, 18075, 18079, 18097, 18104, 18110, 18112, 18113, 18123, 18126, 18133, 18140, 18152, 18153, 18156, 18178, 18183, 18190, 18197, 18198, 18200, 18203, 18222, 18223, 18224, 18233, 18235, 18238, 18246, 18247, 18249, 18251, 18252, 18253, 18259, 18263, 18265, 18270, 18295, 18307, 18314, 18360, 18387, 18391, 18407, 18439, 18443, 18448, 18462, 18479, 18482, 18484, 18488, 18495, 18497, 18498, 18508, 18509, 18518, 18519, 18520, 18531, 18532

**AUTOPSY**
18291, 18425, 18446

**AZO DYE**
18166, 18191

B

**BACTERIA**
18082, 18440, 18441, 18458

**BAFFLES**
18006, 18020, 18089, 18103

**BAG FILTERS**
17906, 17986, 17990, 18114, 18207, 18208

**BALLOONS**
18283, 18290, 18300, 18317

**BARLEY**
18471

**BASIC OXYGEN FURNACES**
17978

**BELGIUM**
17959, 18012, 18230, 18231, 18291

**BENZENE-SOLUBLE ORGANIC MATTER**
18176, 18274, 18432, 18437

**BENZENES**
17970, 18049, 18117, 18212, 18244, 18258, 18377, 18380, 18382, 18477

**BENZO(3-4)PYRENE**
17928, 18042, 18127, 18234, 18254, 18408

**BENZOPYRENES**
17928, 18042, 18127, 18176, 18234, 18254, 18255, 18408

**BERYLLIUM COMPOUNDS**
18160, 18294

**BETA PARTICLES**
18199, 18218

**BIO-ASSAY**
18404

**BIOCLIMATOLOGY**
18277, 18399, 18400, 18418, 18457

**BLACK LIQUOR OXIDATION**
17951, 18009

**BLAST FURNACES**
17978

**BLOOD CELLS**
18395, 18420, 18422, 18434, 18451, 18484

**BLOOD CHEMISTRY**
17961, 18266, 18388, 18391, 18396, 18411, 18424, 18447, 18451, 18495

**BLOOD VESSELS**
18422, 18444

**BLOWBY**
18023, 18067, 18520

**BOILERS**
17919, 17940, 17945, 17965, 18010 18021, 18074, 18080, 18084, 18103, 18112, 18154

**BONES**
17961, 18393, 18396, 18398, 18436

**BREATHING**
18119, 18389, 18427, 18435, 18443

**BREATHING APPARATUS**
18406, 18415

**BREATHING EXERCISES**
18410

**BROMINE**
18160

**BRONCHI**
18440, 18441

**BRONCHITIS**
18384, 18403, 18418, 18419, 18424, 18431, 18437, 18442, 18521

**BRONCHOCONSTRICTION**
18386, 18445

**BRONCHOPNEUMONIA**
18392

**BUDGETS**
18510, 18525

**BUILD-UP RATES**
18276, 18405, 18462

**BUILDINGS**
18087, 18111, 18215, 18248, 18263, 18265, 18345

**BUSES**
17926, 17983, 18014

**BUTENES**
18301

**BY-PRODUCT RECOVERY**
17945, 17951, 17985, 17991, 17996, 17997, 18000, 18041, 18043, 18070, 18072, 18074, 18084, 18098, 18102, 18105, 18115, 18116, 18117, 18478, 18503

C

**CADMIUM**
17920, 17955

**CADMIUM COMPOUNDS**
17955, 17981, 18137, 18148, 18184, 18246, 18247, 18251, 18252, 18264, 18267, 18318, 18411, 18435, 18453

**CALCIUM COMPOUNDS**
17930, 17991, 18078, 18080, 18091, 18114, 18299, 18454

**CALIBRATION METHODS**
18134, 18157, 18160, 18169, 18182, 18185, 18187, 18189, 18191, 18198, 18206, 18214, 18363, 18483

**CALIFORNIA**
17926, 18058, 18183, 18266, 18289, 18418, 18445, 18484, 18488, 18493, 18504, 18532

**CANADA**
17919, 18009, 18045, 18142, 18161, 18290, 18389, 18414, 18425, 18442, 18461

**CANCER**
18394, 18403, 18407, 18421, 18429, 18439, 18442, 18443, 18444

**CARBON BLACK**
17930, 17937, 17938, 17975, 18001, 18012, 18067, 18084, 18085, 18105, 18110, 18174, 18457, 18459, 18466, 18497

**CARBON DIOXIDE**
17913, 17914, 17924, 17950, 17972, 17980, 18027, 18031, 18098, 18100, 18115, 18151, 18182, 18257, 18308

**CARBON DISULFIDE**
18115, 18158

**CARBON MONOXIDE**
17909, 17914, 17924, 17933, 17935, 17939, 17946, 17959, 17962, 17967, 17972, 17983, 18003, 18014, 18031, 18033, 18047, 18052, 18055, 18057, 18071, 18101, 18112, 18115, 18133, 18151, 18155, 18156, 18164, 18183, 18209, 18222, 18223, 18225, 18227, 18233, 18235, 18238, 18249, 18253, 18259, 18263, 18270, 18313, 18314, 18318, 18321, 18374, 18387, 18394, 18444, 18448, 18485, 18487, 18497, 18498, 18505, 18520, 18531

**CARBONATES**
17932, 17982, 18029, 18091

**CARBONYLS**
18001, 18098, 18115

**CARBOXYHEMOGLOBIN**
18448, 18485

**CARBURETION**
18050, 18057, 18058, 18071

**CARBURETOR EVAPORATION LOSSES**
17908, 18036, 18050, 18482

**CARCINOGENS**
18042, 18194, 18408, 18421, 18432, 18444

**CARDIOVASCULAR DISEASES**
18291, 18407, 18418, 18437, 18444

**CASCADE SAMPLERS**
18207, 18312, 18503

**CATALYSIS**
17996, 18000, 18002, 18026, 18031, 18041, 18047, 18048, 18049, 18052, 18084, 18088, 18105, 18107, 18108, 18115, 18140, 18151, 18194, 18200, 18305, 18357, 18359

**CATALYSTS**
17996, 18000, 18002, 18026, 18031, 18041, 18047, 18048, 18049, 18052, 18084, 18088, 18108, 18115, 18140, 18194, 18357, 18359

**CATALYTIC ACTIVITY**
18000, 18031, 18047, 18048, 18052, 18105, 18151, 18305

**CATALYTIC AFTERBURNERS**
17926, 18023, 18031, 18041, 18047, 18052, 18071, 18112, 18497, 18533

**CATALYTIC OXIDATION**
17945, 17951, 17996, 18009, 18032, 18049, 18052, 18084, 18140, 18284, 18322, 18503

**CATS**
18433

**CATTLE**
17950, 18218, 18451, 18452

**CELL GROWTH**
18445

**CELL METABOLISM**
18434

**CELLS**
18392, 18395, 18404, 18420, 18422, 18434, 18440, 18441, 18445, 18451, 18456, 18484

**CEMENTS**
17936, 17962, 17976, 18053

**CENTRIFUGAL SEPARATORS**
17945, 17965, 17990, 18004, 18008, 18013, 18019, 18020, 18028, 18053, 18056, 18060, 18086, 18101, 18208, 18367, 18372, 18376, 18503

**CERAMICS**
17912, 17936, 17971, 18037, 18116

**CHARCOAL**
18115

**CHEMICAL COMPOSITION**
17928, 17938, 17975, 18026, 18053, 18176, 18220, 18226, 18242, 18245, 18247, 18250, 18251, 18252, 18262, 18267, 18272, 18274, 18289, 18299, 18330, 18432, 18437

**CHEMICAL METHODS**
17966, 18125, 18126, 18130, 18137, 18149, 18159, 18161, 18171, 18173, 18187, 18192, 18199, 18200, 18206, 18210, 18231, 18246, 18255, 18256, 18275, 18306, 18371

**CHEMICAL PROCESSING**
17912, 17930, 17936, 17939, 17943, 17948, 17951, 17957, 17961, 17962, 17970, 17971, 17976, 17984, 17987, 18002, 18005, 18015, 18048, 18054, 18059, 18060, 18074, 18081, 18086, 18088, 18101, 18116, 18150, 18151, 18222, 18258, 18274, 18342, 18379, 18385, 18459, 18468, 18477, 18492, 18496, 18497, 18526, 17964

**CHICAGO**
18501

**CHLORIDES**
17982, 18063, 18091, 18275, 18284, 18359, 18406, 18454, 18475, 18477

**CHLORINATED HYDROCARBONS**
18095, 18258, 18330, 18380

**CHLORINE**
17924, 18160, 18206, 18463, 18475

**CHLORINE COMPOUNDS**
17924, 17932, 17982, 18063, 18091, 18159, 18169, 18275, 18284, 18299, 18359, 18406, 18454, 18463, 18475, 18477, 18485

**CHLOROFORM**
18258, 18380

**CHLOROSIS**
18459

**CHROMATOGRAPHY**
17914, 17916, 17950, 17972, 18049, 18065, 18095, 18127, 18131, 18132, 18135, 18145, 18150, 18151, 18165, 18174, 18176, 18185, 18202, 18205, 18212, 18244, 18255, 18269, 18270, 18301, 18330, 18382

**CHROMIUM COMPOUNDS**
17981, 18246, 18251, 18252, 18272, 18371

**CHROMOSOMES**
18404, 18456

**CILIA**
18440, 18441

**CINCINNATI**
18266

**CIRCULATORY SYSTEM**
18422, 18444

**CITIZENS GROUPS**
18219

**CITY GOVERNMENTS**
18505, 18515, 18535

**CLEAN AIR ACT**
17939, 18488

**CLOUD SEEDING**
18298

**CLOUDS**
18124, 18150, 18172, 18278, 18280, 18296, 18298, 18310, 18325, 18331, 18373

**COAL**
17907, 17913, 17934, 17939, 17947, 17957, 17965, 17986, 17989, 17997, 18013, 18025, 18074, 18078, 18080, 18082, 18199, 18201, 18220, 18222, 18280, 18295, 18355, 18387, 18442, 18521, 18501

**COAL CHARACTERISTICS**
17965, 17997, 18082

**COAL PREPARATION**
17907, 17997, 18078, 18082, 18105, 18117, 18477, 18497

**COBALT COMPOUNDS**
17981, 18026, 18272, 18371

**CODES**
18482, 18484, 18508

**COKE**
17962, 17973, 17986, 18002, 18073, 18115, 18118, 18477

**COLLECTORS**
17907, 17919, 17945, 17965, 17984, 17990, 18004, 18006, 18008, 18013, 18019, 18020, 18028, 18044, 18053, 18056, 18060, 18072, 18084, 18086, 18089, 18092, 18101, 18103, 18114, 18118, 18201, 18207, 18208, 18245, 18367, 18372, 18376, 18482, 18499, 18503

**COLORADO**
18241

**COLORIMETRY**
18076, 18134, 18137, 18140, 18146, 18147, 18158, 18162, 18166, 18177, 18178, 18188, 18191, 18192, 18193, 18194, 18196, 18206, 18217, 18273, 18275, 18339, 18369, 18382

**COLUMN CHROMATOGRAPHY**
18145, 18212

COMBUSTION
17914, 17915, 17918, 17927, 17937, 17940, 17949, 17965, 17974, 17976, 17978, 18034, 18058, 18067, 18132, 18138, 18201, 18364

COMBUSTION AIR
17919, 17940, 17957, 17993, 18009, 18030, 18058, 18067, 18104, 18201, 18203

COMBUSTION GASES
17906, 17909, 17912, 17914, 17938, 17939, 17940, 17945, 17947, 17951, 17957, 17972, 17973, 17980, 17982, 17986, 17987, 17989, 17991, 17992, 17993, 17996, 18001, 18005, 18006, 18009, 18010, 18011, 18012, 18013, 18015, 18018, 18021, 18022, 18029, 18032, 18043, 18046, 18048, 18049, 18052, 18059, 18061, 18068, 18069, 18070, 18074, 18075, 18076, 18080, 18081, 18083, 18084, 18086, 18089, 18097, 18098, 18101, 18102, 18105, 18107, 18116, 18117, 18118, 18124, 18126, 18138, 18148, 18151, 18154, 18162, 18170, 18178, 18184, 18186, 18199, 18208, 18212, 18224, 18245, 18257, 18280, 18286, 18291, 18295, 18319, 18350, 18439, 18459, 18475, 18485, 18489, 18491, 18521, 18496, 18499, 18503, 18508, 18509, 18523, 18532, 18533, 17964

COMBUSTION PRODUCTS
17906, 17909, 17912, 17914, 17919, 17929, 17934, 17938, 17939, 17940, 17945, 17947, 17951, 17957, 17972, 17973, 17980, 17982, 17986, 17987, 17989, 17991, 17992, 17993, 17996, 18001, 18005, 18006, 18009, 18010, 18011, 18012, 18013, 18015, 18018, 18021, 18022, 18029, 18032, 18043, 18046, 18048, 18049, 18052, 18059, 18061, 18068, 18069, 18070, 18074, 18075, 18076, 18080, 18081, 18082, 18083, 18084, 18086, 18089, 18092, 18097, 18098, 18101, 18102, 18103, 18105, 18107, 18116, 18117, 18118, 18124, 18126, 18138, 18148, 18151, 18154, 18162, 18170, 18178, 18184, 18186, 18199, 18201, 18208, 18212, 18220, 18224, 18245, 18257, 18280, 18286, 18291, 18295, 18319, 18350, 18439, 18459, 18475, 18485, 18489, 18491, 18521, 18496, 18497, 18499, 18503, 18508, 18509, 18523, 18532, 18533, 17964

COMMERCIAL EQUIPMENT
18022

COMMERCIAL FIRMS
18508

COMPLAINTS
17973, 18224, 18244, 18245, 18354, 18385, 17964

COMPLIANCE
18415, 18449

COMPRESSION
18364

COMPUTER PROGRAMS
17926, 17931, 18003, 18203, 18307, 18389, 18426, 18503

COMPUTERS
18009, 18140, 18307

CONCRETE
18220

CONDENSATION
17984, 17994, 17996, 18110, 18163, 18172, 18364

CONDENSATION (ATMOSPHERIC)
17936, 18124, 18150, 18172, 18229, 18239, 18278, 18279, 18280, 18284, 18286, 18288, 18291, 18295, 18296, 18298, 18308, 18310, 18323, 18325, 18331, 18341, 18353, 18373, 18386, 18419, 18431, 18521

CONSTRUCTION MATERIALS
17911, 17922, 17936, 17962, 17976, 18053, 18109, 18220

CONTACT PROCESSING
18379

CONTINUOUS MONITORING
17972, 18126, 18139, 18149, 18152, 18153, 18161, 18165, 18166, 18180, 18188, 18199, 18200, 18205, 18206, 18227, 18228, 18249, 18256, 18287, 18399, 18406, 18411, 18438, 18505

CONTROL AGENCIES
18493, 18502, 18505, 18506, 18507, 18510, 18523

CONTROL PROGRAMS
17976, 18062, 18113, 18254, 18307, 18397, 18399, 18404, 18521, 18493, 18495, 18496, 18497, 18498, 18499, 18501, 18505, 18519, 18520, 18523, 18525, 18529

CONTROLLED ATMOSPHERES
17950, 18100, 18111, 18155, 18215

CONVECTION
17978

CONVECTION (ATMOSPHERIC)
18332, 18345

COOLING
17954, 17988, 18004, 18023, 18051, 18080, 18114, 18207, 18280, 18286, 18308

COPPER
18114, 18379, 18388, 18411, [illegible]

COPPER ALLOYS
18411

COPPER COMPOUNDS
17981, 18047, 18194, 18206, 18246, 18247, 18250, 18251, 18252, 18264, 18267, 18284, 18371, 18406, 18411, 18453

CORN
18329

CORONA
18045, 18064, 18094

CORROSION
17930, 17982, 18021, 18039, 18084, 18102, 18146, 18474, 18475, 18477

COSTS
17913, 17916, 17920, 17921, 17926, 17939, 17955, 17973, 17978, 17983, 17986, 17990, 17995, 17997, 18002, 18004, 18013, 18015, 18019, 18020, 18021, 18025, 18032, 18035, 18043, 18062, 18072, 18082, 18084, 18088, 18105, 18108, 18123, 18201, 18208, 18276, 18479, 18481, 18521, 18497, 18501, 18503, 18507, 18512, 18519, 18526

COTTON
18472

COUNTER CURRENTS
18226, 18283, 18288, 18336, 18337, 18338

COUNTY GOVERNMENTS
18493

CRACKING
18037

CRANKCASE EMISSIONS
17958, 18023, 18067, 18520

CRITERIA
17909, 17961, 17998, 18020, 18046, 18062, 18081, 18116, 18152, 18172, 18482, 18485, 18487, 18490, 18492, 18505

CROPS
17922, 17928, 17979, 18145, 18329, 18455, 18457, 18458, 18462, 18464, 18465, 18466, 18467, 18471, 18472, 18473, 18490

CUMULATIVE METHODS
18237, 18243, 18268, 18273, 18275, 18287, 18303, 18410

CUPOLAS
17906, 18118, 18208

CYANATES
18445, 18477

CYANIDES
18477

CYCLIC ALKANES
18192

CYCLONES (ATMOSPHERIC)
18330

CZECHOSLOVAKIA
18095, 18427

D

DATA ANALYSES
18232, 18489, 18503

DATA HANDLING SYSTEMS
17926, 17931, 18003, 18203, 18232, 18276, 18307, 18389, 18426, 18489, 18501, 18503

DECOMPOSITION
17988, 18054, 18063, 18079, 18380

DENSITY
18026, 18199, 18248, 18311, 18331, 18334, 18345, 18373, 18389

DEPOSITION
17979, 18038, 18085, 18325, 18327, 18329, 18389, 18391, 18460, 18469, 18471

DESULFURIZATION OF FUELS
17907, 17939, 17945, 17997, 18000, 18013, 18026, 18078, 18082, 18105, 18108, 18117, 18477, 18497

DIAGNOSES
18291, 18384, 18385, 18393, 18396, 18397, 18399, 18404, 18408, 18411, 18417, 18421, 18424, 18425, 18429, 18445, 18446, 18495

DIESEL ENGINES
17925, 17935, 17937, 17957, 17977, 17983, 18014, 18067, 18104, 18133, 18153, 18295, 18443, 18533

DIFFRACTION
18242, 18308

DIFFUSION
18020, 18046, 18128, 18211, 18220, 18221, 18224, 18228, 18242, 18243, 18269, 18276, 18277, 18281, 18287, 18292, 18297, 18302, 18303, 18305, 18307, 18315, 18316, 18317, 18321, 18327, 18328, 18329, 18332, 18333, 18335, 18340, 18342, 18343, 18345, 18346, 18347, 18349, 18350, 18352, 18357, 18362, 18375, 18381, 18389, 18521, 18501, 18503, 18527

DIFFUSION MODELS
18276, 18277, 18281, 18297, 18302, 18307, 18327, 18329, 18332, 18333, 18335, 18340, 18342, 18346, 18501, 18503, 18527

DIGESTERS
17950

DIGESTION
18428

DIGESTIVE SYSTEM
18388, 18390, 18392, 18395, 18417, 18433, 18451, 18452

DIGITAL METHODS
18123, 18227

DISPERSIONS
18015, 18073, 18417

DISPLACEMENT
18359

DISSIPATION RATES
18327

DISSOCIATION
18311, 18361

DISTILLATE OILS
17947, 18069, 18212, 18257

DOGS
18414, 18443

DOMESTIC HEATING
17934, 17936, 17942, 17962, 17968, 18013, 18025, 18222, 18254, 18257, 18295, 18387, 18401, 18442, 18492, 18501, 18505, 18509

DONORA
18418

DROPLETS
18015, 18081, 18278, 18362, 18381

DRUGS
18396, 18398, 18420, 18421, 18440, 18441

DRY CLEANING
18103

DRYING
18106, 18217

DUST FALL
18219, 18236, 18245, 18260, 18339, 18410, 18485, 18505

DUSTS
17906, 17907, 17911, 17912, 17919, 17934, 17936, 17962, 17965, 17971, 17976, 17986, 17990, 17991, 18006, 18011, 18017, 18019, 18021, 18022, 18028, 18030, 18038, 18044, 18045, 18051, 18053, 18060, 18064, 18066, 18072, 18081, 18084, 18086, 18087, 18090, 18092, 18094, 18095, 18096, 18101, 18111, 18116, 18119, 18120, 18121, 18142, 18170, 18201, 18207, 18208, 18214, 18215, 18216, 18219, 18220, 18223, 18227, 18236, 18245, 18274, 18289, 18306, 18330, 18339, 18353, 18394, 18432, 18443, 18460, 18462, 18482, 18485, 18492, 18533

DYNAMOMETERS
17975, 18057, 18133, 18197, 18474

E

ECONOMIC LOSSES
18450, 18476, 18480, 18481

EDUCATION
18204, 18524, 18525, 18527, 18532

ELECTRIC FURNACES
17986, 18044, 18114, 18245

ELECTRIC POWER PRODUCTION
17909, 17913, 17921, 17929, 17934, 17939, 17940, 17945, 17954, 17962, 17963, 17968, 17976, 17978, 17982, 17989, 17990, 17993, 18011, 18013, 18014, 18025, 18038, 18039, 18074, 18078, 18085, 18086, 18093, 18128, 18220, 18239, 18274, 18279, 18280, 18286, 18328, 18373, 18492, 18497, 18501, 18504, 18533

ELECTRIC PROPULSION
17913, 17920, 17921, 17926, 17931, 17932, 17978, 17995, 18014, 18109, 18112, 18452

ELECTRICAL MEASUREMENT DEVICES
18173

ELECTRICAL PROPERTIES
17920, 18020, 18034, 18045, 18051, 18064, 18094, 18115, 18143, 18161, 18199, 18200, 18374, 18375, 18460

ELECTRICAL RESISTANCE
18020, 18161

ELECTROCHEMICAL METHODS
17966, 18125, 18149, 18161, 18173, 18199, 18200, 18206, 18210, 18246, 18256

ELECTROCONDUCTIVITY ANALYZERS
18139, 18165, 18180, 18188, 18200, 18206, 18228, 18287

ELECTRON MICROSCOPY
18157, 18308, 18373, 18440, 18441

ELECTROSTATIC COUNTERS
18199

ELECTROSTATIC PRECIPITATORS
17945, 17965, 17989, 17990, 18004, 18012, 18013, 18016, 18017, 18019, 18020, 18022, 18051, 18053, 18064, 18072, 18081, 18082, 18086, 18094, 18096, 18111, 18245, 18475, 18499, 18503

ELUTRIATION
17997

EMISSION INVENTORIES
18277, 18485, 18501

EMISSION STANDARDS
17909, 17912, 17926, 17961, 17965, 17990, 18033, 18057, 18058, 18071, 18112, 18113, 18153, 18485, 18487, 18488, 18489, 18492, 18497, 18501, 18506, 18523

EMISSIVITY
18129

EMPHYSEMA
18384, 18424, 18425, 18443

EMULSIONS
18015, 18073

ENFORCEMENT PROCEDURES
18493, 18494, 18499, 18505, 18506, 18531

ENGINE DESIGN MODIFICATION
17920, 17926, 17932, 17953, 17969, 17995, 17999, 18014, 18036, 18039, 18058, 18071, 18113, 18479, 18519

ENGINE OPERATING CYCLES
17908, 17915, 17917, 17920, 17926, 17931, 17937, 17941, 17949, 17958, 17967, 17975, 17983, 18031, 18050, 18057, 18079, 18133, 18153, 18156, 18203, 18233, 18520

ENGINE OPERATION MODIFICATION
17926, 17937, 17946, 17953, 17967, 17983, 17999, 18023, 18033, 18042, 18047, 18050, 18055, 18057, 18058, 18067, 18071, 18075, 18079, 18104, 18113, 18152, 18156, 18183, 18203, 18362, 18497, 18519

ENGINEERS
18257, 18527

ENZYMES
18388, 18395, 18398, 18416, 18434, 18467, 18484

EPIDEMIOLOGY
18383, 18407, 18418, 18425, 18429, 18430, 18431, 18444, 18485

EPITHELIUM
18427

EQUIPMENT CRITERIA
17998, 18020, 18046, 18062, 18081, 18116, 18152, 18172, 18482

EQUIPMENT STANDARDS
18214, 18215, 18482, 18483

ESTERS
18054, 18244

ETHYLENE
17938, 18041, 18141, 18187, 18241, 18450

EUROPE
17910, 17912, 17917, 17924, 17928, 17929, 17934, 17936, 17937, 17939, 17940, 17942, 17948, 17951, 17952, 17959, 17961, 17962, 17963, 17965, 17966, 17970, 17973, 17978, 17979, 17987, 17988, 17990, 18000, 18004, 18005, 18011, 18012, 18013, 18015, 18016, 18017, 18018, 18025, 18027, 18028, 18030, 18033, 18038, 18040, 18042, 18043, 18046, 18047, 18051, 18053, 18057, 18058, 18059, 18060, 18068, 18069, 18074, 18083, 18086, 18095, 18096, 18098, 18101, 18105, 18109, 18115, 18116, 18117, 18119, 18120, 18121, 18122, 18123, 18124, 18125, 18127, 18128, 18132, 18133, 18134, 18135, 18136, 18138, 18144, 18152, 18153, 18154, 18160, 18164, 18165, 18169, 18173, 18174, 18183, 18211, 18213, 18218, 18230, 18231, 18232, 18233, 18234, 18236, 18238, 18239, 18248, 18254, 18260, 18261, 18271, 18278, 18281, 18282, 18288, 18291, 18292, 18294, 18295, 18310, 18312, 18323, 18328, 18341, 18345, 18346, 18347, 18349, 18354, 18355, 18357, 18359, 18361, 18365, 18366, 18367, 18372, 18374, 18378, 18379, 18381, 18388, 18390, 18392, 18394, 18395, 18401, 18403, 18405, 18406, 18407, 18415, 18416, 18417, 18418, 18419, 18421, 18422, 18426, 18427, 18428, 18429, 18431, 18433, 18435, 18439, 18442, 18447, 18451, 18453, 18457, 18459, 18463, 18464, 18465, 18466, 18467, 18468, 18471, 18473, 18475, 18477, 18486, 18489, 18491, 18492, 18521, 18494, 18498, 18505, 18508, 18509, 18511, 18512, 18513, 18514, 18519, 18522, 18524, 18528, 17964, 18535

EXCESS AIR
17940, 18009, 18104

EXCRETIONS
18396, 18399, 18414, 18423, 18451

EXHAUST SYSTEMS
17986, 18035, 18061, 18066, 18087, 18128, 18208, 18483

EXPERIMENTAL EQUIPMENT
17927, 18017, 18020, 18128, 18143, 18144, 18160, 18164, 18181, 18326

EXPERIMENTAL METHODS
17917, 17931, 17946, 18128, 18137, 18142, 18166, 18169, 18191, 18192, 18196, 18199, 18217, 18285, 18371, 18378, 18445, 18464

EXPLOSIONS
18019, 18039

EXPOSURE CHAMBERS
18472

EXPOSURE METHODS
18392, 18394, 18395, 18408, 18413, 18414, 18415, 18422, 18435, 18438, 18443, 18447, 18451, 18456, 18471, 18473

EYE IRRITATION
18407, 18418

EYES
18384

F

FALLOUT
17929, 18294, 18462

FANS (BLOWERS)
18035, 18061, 18087

FARMS
17922, 18451

FEASIBILITY STUDIES
17906, 17907, 17909, 17913, 17921, 17944, 18002, 18019, 18116, 18326, 18408, 18473

FEDERAL GOVERNMENTS
18209, 18488, 18491, 18492, 18494, 18495, 18498, 18502, 18514, 18515, 18524, 18529, 18535

FEED LOTS
17911, 17912, 18222

FERTILIZER MANUFACTURING
17971, 17976, 18063, 18068, 18072, 18274

FERTILIZING
18457, 18462, 18473

FIELD TESTS
17923, 17958, 18134, 18363

FILTER FABRICS
17976, 17985, 18016, 18044, 18053, 18060, 18114, 18116, 18148, 18175, 18180, 18184, 18207, 18379, 18496, 18503, 18513

FILTERS
17906, 17976, 17982, 17985, 17986, 17989, 17990, 17998, 18004, 18012, 18013, 18016, 18020, 18030, 18044, 18053, 18060, 18061, 18085, 18087, 18090, 18095, 18100, 18111, 18114, 18116, 18118, 18130, 18148, 18151, 18159, 18160, 18174, 18175, 18180, 18184, 18201, 18207, 18208, 18364, 18366, 18379, 18460, 18483, 18496, 18499, 18503, 18513

FIRING METHODS
17919, 17937, 17940, 17957, 17993, 18003, 18009, 18015, 18032, 18050, 18057, 18058, 18067, 18104, 18201, 18203, 18257

FLAME AFTERBURNERS
17926, 17992, 18003, 18037, 18050, 18055, 18071, 18112, 18497

FLAME IONIZATION DETECTOR
17972, 18132, 18205, 18212

FLARES
17907, 18101

FLORIDA
18446, 18470, 18502

FLOWERS
18241, 18450

FLUID FLOW
17946, 17949, 17974, 17982, 17991, 18008, 18012, 18016, 18020, 18023, 18031, 18034, 18049, 18059, 18065, 18079, 18081, 18111, 18115, 18121, 18141, 18144, 18154, 18157, 18160, 18163, 18203, 18208, 18360, 18366, 18368, 18375, 18376, 18413, 18449, 18469, 18471, 18503

FLUORANTHENES
17928, 18234, 18255

FLUORENES
17928

FLUORESCENCE
18127, 18141, 18176, 18187, 18198, 18254, 18464, 18465

FLUORIDES
18063, 18072, 18076, 18461, 18485

FLUORINE
17912, 17924, 18463

FLUORINE COMPOUNDS
17924, 18063, 18072, 18076, 18461, 18463, 18485

FLUOROSIS
18447

FLY ASH
17909, 17945, 17982, 17989, 18011, 18022, 18080, 18081, 18086, 18092, 18094, 18101

FOG
17936, 18239, 18278, 18279, 18280, 18284, 18286, 18291, 18295, 18308, 18323, 18353, 18386, 18419, 18431, 18521

FOOD AND FEED OPERATIONS
17911, 17922, 17950, 17971, 17976, 17978, 18035, 18106, 18167

FOODS
17912, 18131, 18218, 18266, 18387, 18416, 18452

FORESTS
17912

FORMALDEHYDES
17977, 18192, 18249, 18382

FORMIC ACID
17912

FRACTIONATION
18145, 18151

FRANCE
17951, 17962, 18011, 18015, 18017, 18038, 18128, 18133, 18138, 18160, 18173, 18174, 18211, 18218, 18233, 18292, 18345, 18407, 18491, 18508, 18514, 18524

FREE RADICALS
18305

FROTH FLOATATION
18082

FRUITS
18450, 18459, 18470

FUEL ADDITIVES
17917, 17923, 17953, 17958, 17961, 17970, 17975, 18002, 18023, 18024, 18042, 18058, 18076, 18088, 18107, 18246, 18391, 18462, 18474, 18484, 18526

FUEL CELLS
17913, 17921, 17932, 17978, 18109

FUEL CHARGING
17919, 18015, 18057

FUEL CRITERIA
17961, 18492

FUEL EVAPORATION
17908, 17958, 18023, 18036, 18050, 18110, 18482

FUEL GASES
17910, 17913, 17914, 17939, 17940, 17957, 17960, 17968, 17983, 18027, 18039, 18105, 18295, 18387, 18521, 18501, 18509, 18514

FUEL OIL PREPARATION
17939, 18000, 18013, 18026, 18078, 18108

FUEL OILS
17939, 17940, 17947, 17957, 17958, 17968, 17983, 18000, 18013, 18021, 18025, 18069, 18070, 18073, 18074, 18078, 18085, 18093, 18103, 18107, 18108, 18199, 18212, 18220, 18251, 18257, 18273, 18295, 18452, 18482, 18521, 18501, 18509, 18514, 18523

FUEL STANDARDS
17961, 17970, 18058, 18246, 18523, 18526

FUEL TANK EVAPORATION
17908, 18050, 18110

FUMES
17962, 18019, 18021, 18032, 18041, 18114, 18148, 18417, 18443, 18462

FUNGI
18240, 18271, 18470

FURNACES
17906, 17940, 17947, 17972, 17973, 17974, 17978, 17980, 17986, 18009, 18044, 18074, 18085, 18098, 18102, 18114, 18116, 18118, 18208, 18245, 18257, 18482, 18485

G

GAS CHROMATOGRAPHY
17914, 17950, 17972, 18049, 18065, 18132, 18150, 18151, 18165, 18174, 18185, 18202, 18205, 18212, 18244, 18269, 18270, 18301, 18382

GAS SAMPLING
17972, 17975, 18136, 18143, 18156, 18170, 18182, 18208, 18231, 18470

GAS TURBINES
17926, 17957, 17972, 17993, 18039

GASIFICATION (SYNTHESES)
18078, 18117, 18477

GASOLINES
17917, 17923, 17943, 17953, 17957, 17958, 17961, 17966, 17970, 18002, 18023, 18024, 18042, 18057, 18058, 18069, 18071, 18079, 18088, 18246, 18295, 18391, 18448, 18462, 18474, 18495, 18498, 18526

GENETICS
18404, 18408

GERMANY
17912, 17917, 17934, 17961, 17962, 17963, 17965, 17970, 17973, 17988, 17990, 18027, 18028, 18030, 18042, 18047, 18053, 18074, 18086, 18096, 18109, 18120, 18121, 18122, 18123, 18144, 18152, 18153, 18183, 18232, 18236, 18238, 18248, 18260, 18261, 18281, 18288, 18365, 18422, 18428, 18439, 18491, 18494, 18498, 18508, 18511, 18512, 18514, 18519, 18522, 18524

GLASS FABRICS
17976, 18114, 18148, 18175, 18180, 18184, 18207, 18379, 18496, 18513

GRANTS
18492, 18499

GRAPES
18459

GRAPHITE
17986

GRASSES
17922, 18457, 18462, 18464, 18465, 18466, 18467, 18473

GRAVITY SETTLING
17986, 18013, 18020, 18082, 18375

GREAT BRITAIN
17910, 17917, 17928, 17936, 17937, 17978, 18013, 18016, 18033, 18046, 18051, 18057, 18060, 18124, 18127, 18132, 18135, 18136, 18154, 18213, 18234, 18239, 18282, 18355, 18394, 18401, 18403, 18406, 18416, 18418, 18419, 18421, 18431, 18442, 18451, 18453, 18471, 18491, 18492, 18521, 18508, 18509, 18512, 18513, 18514, 18524, 18528, 17964

# SUBJECT INDEX

GROUND LEVEL
18011, 18218, 18247, 18281, 18282, 18293, 18294, 18295, 18318, 18328, 18335, 18342, 18349

GUINEA PIGS
18440, 18441

## H

HALOGEN GASES
17912, 17924, 18160, 18161, 18181, 18206, 18463, 18475

HALOGENATED HYDROCARBONS
18095, 18181, 18258, 18330, 18380

HAMSTERS
18443

HARBORS
18091

HAZE
18124, 18229, 18288

HEADACHE
18387

HEALTH IMPAIRMENT
18137, 18385, 18387, 18390, 18391, 18402, 18407, 18411, 18416, 18444, 18446, 18518

HEALTH STATISTICS
18384, 18403, 18407, 18418, 18429, 18431, 18437, 18442

HEARINGS
18488

HEART
18444

HEAT CAPACITY
18075

HEAT OF COMBUSTION
18037, 18280

HEAT TRANSFER
17940, 17954, 17969, 17978, 17988, 17996, 18004, 18013, 18023, 18034, 18037, 18041, 18051, 18080, 18102, 18106, 18114, 18130, 18207, 18280, 18286, 18290, 18308, 18328, 18357, 18362, 18381

HEIGHT FINDING
18046, 18501, 18503, 18535

HEMATOLOGY
17961, 18266, 18388, 18391, 18396, 18411, 18416, 18417, 18420, 18423, 18424, 18438, 18447, 18448, 18451, 18484, 18485, 18495

HEMOGLOBIN INTERACTIONS
18447, 18484

HI-VOL SAMPLERS
18188, 18242, 18245, 18246, 18250, 18251, 18252, 18255, 18262, 18265, 18267, 18318, 18322, 18410

HIGHWAYS
17908, 17926, 17958, 18113, 18224, 18394, 18454

HISTAMINES
18445

HORMONES
18450

HOT SOAK
18036, 18050

HUMIDITY
18012, 18085, 18102, 18111, 18123, 18124, 18125, 18215, 18278, 18279, 18280, 18284, 18286, 18298, 18310, 18312, 18313, 18319, 18323, 18324, 18339, 18352, 18353, 18354, 18386, 18455, 18471, 18475

HYDRAZINES
18194

HYDROCHLORIC ACID
18206, 18406, 18475

HYDROCYANIC ACID
18444

HYDRODESULFURIZATION
18000, 18026, 18108

HYDROFLUORIC ACID
18076, 18264, 18447

HYDROGEN
17914, 17978, 17983, 18078, 18159, 18205

HYDROGEN SULFIDE
17924, 17930, 17996, 18009, 18027, 18039, 18043, 18059, 18078, 18083, 18091, 18098, 18099, 18101, 18105, 18115, 18117, 18134, 18159, 18200, 18258, 18269, 18275, 18379, 18415, 18438, 18477

HYDROGENATION
17996

HYDROLYSIS
17996

HYDROSPHERE
18323, 18330, 18533

HYGROSCOPICITY
18278

## I

ICE
18172, 18280, 18298, 18308, 18319

ILLINOIS
18501

INCINERATION
17911, 17919, 17936, 17957, 17971, 17976, 18004, 18012, 18013, 18015, 18022, 18032, 18041, 18061, 18055, 18106, 18475, 18508

INDUSTRIAL AREAS
17959, 17973, 18150, 18186, 18221, 18222, 18224, 18236, 18237, 18244, 18245, 18252, 18255, 18256, 18258, 18260, 18261, 18262, 18266, 18267, 18269, 18272, 18273, 18288, 18303, 18317, 18328, 18339, 18342, 18343, 18407, 18439, 18459, 18461, 18493, 18496, 18499, 18505, 18509

INDUSTRIAL EMISSION SOURCES
17906, 17909, 17910, 17911, 17912, 17913, 17916, 17919, 17921, 17922, 17929, 17930, 17934, 17936, 17939, 17940, 17942, 17943, 17945, 17948, 17950, 17951, 17952, 17954, 17957, 17959, 17961, 17962, 17963, 17968, 17970, 17971, 17973, 17976, 17978, 17982, 17984, 17985, 17986, 17987, 17989, 17990, 17993, 18002, 18004, 18005, 18008, 18009, 18011, 18012, 18013, 18014, 18015, 18016, 18019, 18022, 18025, 18032, 1[illegible]35, 18038, 18039, 18041, 18044, 18045, 1804[illegible] 18053, 18054, 18059, 18060, 18061, 18062, 18063, 18065, 18066, 18068, 18070, 180[illegible], 18073, 18074, 18076, 18078, 18080, 18081, 18084, 18085, 18086, 18088, 18091, 18093, 18098, 18101, 18102, 18103, 18106, 18110, 18116, 18118, 18128, 18130, 18151, 18161, 18167, 18200, 18215, 18218, 18220, 18222, 18226, 18236, 18239, 18244, 18245, 18254, 18258, 18269, 18272, 18274, 18279, 18280, 18286, 18295, 18328, 18342, 18344, 18357, 18373, 18379, 18385, 18388, 18390, 18405, 18406, 18411, 18443, 18459, 18461, 18462, 18468, 18475, 18476, 18477, 18478, 18492, 18496, 18497, 18499, 18501, 18504, 18505, 18508, 18513, 18526, 18533, 17964

INERTIAL SEPARATION
18013, 18020

INFECTIOUS DISEASES
18402

INFRARED RADIATION
18285

INFRARED SPECTROMETRY
17972, 18142, 18253, 18259

INGESTION
18370, 18390, 18397, 18398, 18399, 18436, 18451

INHALATION THERAPY
18390, 18409, 18423, 18433

INHIBITION
18420, 18458, 18467, 18474

INORGANIC ACIDS
17939, 17945, 17957, 18048, 18070, 18074, 18076, 18084, 18105, 18146, 18147, 18175, 18188, 18206, 18264, 18284, 18334, 18342, 18353, 18354, 18386, 18406, 18447, 18459, 18468, 18475, 18485

INSPECTION
18113, 18493, 18508, 18520

INSTRUCTORS
18219

INSTRUMENTATION
17908, 18009, 18153, 18154, 18155, 18157, 18161, 18165, 18170, 18197, 18277, 18363, 18426, 18427

INTERMITTENT MONITORING
18173, 18223

INTERNAL COMBUSTION ENGINES
17915, 17925, 17926, 17935, 17937, 17946, 17949, 17957, 17967, 17977, 17983, 17994, 17999, 18014, 18023, 18024, 18039, 18042, 18056, 18057, 18058, 18067, 18079, 18104, 18112, 18133, 18152, 18153, 18295, 18387, 18443, 18474, 18479, 18533

INVERSION
17936, 18239, 18261, 18280, 18281, 18288, 18300, 18310, 18345, 18348, 18418, 18431, 18521, 18501

IODIDES
18159, 18192

IODIMETRIC METHODS
18126, 18137, 18159, 18173, 18187, 18192, 18275, 18306

IODINE
18161

IODINE COMPOUNDS
18137, 18159, 18192

IONIZATION
181[illegible], 18311

IONS
17[illegible]8, 18034, 18144, 18155, 18299, 18311, 18326, 18361, 18374, 18417, 18420, 18453

IRON
17906, 17973, 17976, 17982, 17985, 17986, 18021, 18044, 18062, 18066, 18102, 18118, 18146, 18208, 18245, 18272, 18379, 18475, 18496

**IRON COMPOUNDS**
18024, 18047, 18082, 18091, 18137, 18160, 18206, 18242, 18246, 18247, 18250, 18251, 18252, 18267, 18272, 18371, 18406, 18411, 18453, 18475

**IRON OXIDES**
18099, 18105, 18114, 18242, 18334, 18411, 18475

**IRRADIATION CHAMBERS**
17925

**ISOTOPES**
17960, 18040, 18160, 18174, 18218, 18272, 18282, 18294, 18325, 18356, 18367, 18372, 18395, 18457, 18466, 18471

**ITALY**
18000, 18018, 18083, 18310, 18357, 18366, 18390, 18395, 18433

## J

**JAPAN**
17911, 17914, 17933, 17935, 17938, 17939, 17941, 17949, 17957, 17968, 17972, 17973, 17974, 17980, 17981, 17991, 18031, 18037, 18044, 18049, 18052, 18054, 18058, 18063, 18064, 18065, 18066, 18067, 18070, 18073, 18075, 18076, 18084, 18085, 18090, 18091, 18104, 18107, 18110, 18111, 18112, 18114, 18126, 18139, 18140, 18141, 18146, 18147, 18148, 18149, 18150, 18156, 18158, 18159, 18162, 18167, 18168, 18170, 18171, 18175, 18176, 18177, 18178, 18180, 18182, 18184, 18185, 18186, 18187, 18188, 18193, 18201, 18202, 18205, 18206, 18207, 18208, 18210, 18214, 18215, 18220, 18221, 18222, 18223, 18224, 18225, 18226, 18227, 18228, 18235, 18237, 18242, 18243, 18244, 18245, 18246, 18247, 18249, 18250, 18251, 18252, 18253, 18255, 18258, 18259, 18262, 18263, 18264, 18267, 18268, 18269, 18270, 18272, 18273, 18283, 18287, 18301, 18302, 18303, 18304, 18306, 18307, 18313, 18314, 18315, 18316, 18317, 18318, 18320, 18321, 18322, 18324, 18333, 18334, 18335, 18336, 18337, 18338, 18339, 18340, 18343, 18344, 18348, 18350, 18351, 18352, 18353, 18364, 18368, 18369, 18382, 18383, 18384, 18385, 18423, 18424, 18437, 18485, 18491, 18495, 18496, 18497, 18499, 18507, 18508, 18509, 18512, 18513, 18514, 18520, 18523, 18524, 18526, 18530, 18531, 18532, 17964

**JET AIRCRAFT**
18014, 18360

## K

**KEROSENE**
17977, 17980, 18069, 18222

**KETONES**
18027, 18077, 18428

**KIDNEYS**
18395, 18397, 18398, 18417, 18433, 18451

**KILNS**
17971, 18070, 18074, 18076, 18080, 18084, 18091, 18102

**KONIMETERS**
18030

**KRAFT PULPING**
17930, 17984, 17987, 18150, 18497

## L

**LABORATORY ANIMALS**
18392, 18394, 18395, 18402, 18408, 18409, 18413, 18414, 18417, 18422, 18432, 18433, 18435, 18438, 18440, 18441, 18443, 18447

**LABORATORY FACILITIES**
17927, 17947, 18010, 18190, 18197, 18277, 18360, 18427, 18460, 18469, 18496

**LACQUERS**
17912, 18244

**LANDFILLS**
17906, 18496

**LARYNX**
18384

**LASERS**
18120, 18124, 18277

**LAUNDRIES**
18103

**LEAD**
17920, 18406, 18485

**LEAD ALLOYS**
18406

**LEAD COMPOUNDS**
17912, 17917, 17923, 17932, 17939, 17943, 17953, 17958, 17961, 17970, 17975, 17979, 17981, 18002, 18023, 18024, 18052, 18057, 18058, 18071, 18088, 18112, 18148, 18160, 18184, 18198, 18246, 18247, 18250, 18251, 18252, 18263, 18264, 18265, 18266, 18267, 18270, 18318, 18334, 18356, 18359, 18369, 18370, 18371, 18387, 18391, 18393, 18395, 18396, 18397, 18398, 18399, 18405, 18406, 18423, 18436, 18448, 18451, 18452, 18453, 18462, 18474, 18484, 18485, 18487, 18495, 18498, 18526

**LEAD PEROXIDE CANDLE**
18237, 18243, 18268, 18273, 18275, 18287, 18303, 18410

**LEAVES**
18459, 18460, 18463, 18468, 18469, 18471, 18472

**LEGISLATION**
17936, 17939, 17942, 17954, 17955, 17962, 17971, 18046, 18485, 18488, 18492, 18493, 18494, 18498, 18499, 18500, 18502, 18505, 18506, 18508, 18511, 18519

**LIGHT SCATTERING**
18248, 18285, 18373

**LIME**
18070, 18074, 18080, 18084, 18091

**LIMESTONE**
17945, 17989, 18010, 18074, 18078, 18503

**LINE SOURCES**
18340

**LIPIDS**
18388

**LIQUIDS**
17913, 17914, 17946, 17991, 18008, 18069, 18088, 18098, 18154, 18279, 18298, 18358, 18371, 18376

**LITHIUM COMPOUNDS**
17932

**LITIGATION**
18500

**LIVER**
18388, 18392, 18395, 18451

**LOCAL GOVERNMENTS**
18490, 18491, 18492, 18502, 18506, 18515, 18524, 18529

**LONDON**
18418, 18419, 18521, 18509, 18513, 18524

**LOS ANGELES**
18266, 18418, 18445, 18493, 18532

**LOWER ATMOSPHERE**
18218, 18247, 18282, 18283, 18297, 18300, 18318, 18328, 18339, 18349

**LUBRICANTS**
17912, 17923, 17958, 17986, 18023, 18042, 18452

**LUNG CANCER**
18403, 18429, 18439, 18442, 18443

**LUNG CLEARANCE**
18440, 18441

**LUNGS**
17961, 18392, 18394, 18407, 18425, 18439, 18440, 18441, 18444, 18445, 18446

## M

**MAGNESIUM COMPOUNDS**
17987, 18114, 18299, 18411, 18420, 18475

**MAGNETIC SEPARATION**
18082

**MAGNETOHYDRODYNAMICS (MHD)**
17978, 18039

**MAINTENANCE**
17958, 18019, 18056, 18087, 18096, 18101, 18113, 18130, 18207

**MANAGEMENT PERSONNEL**
18524

**MANGANESE**
18245

**MANGANESE COMPOUNDS**
17981, 18052, 18114, 18160, 18245, 18246, 18247, 18250, 18251, 18252, 18264, 18267, 18272, 18284, 18318, 18322, 18371

**MANGANESE DIOXIDE (JAPANESE)**
18043, 18084, 18497

**MANGANESE SULFATES**
18284

**MANUAL**
18194

**MAPPING**
18260

**MARYLAND**
18257

**MASS SPECTROMETRY**
18107, 18143, 18155, 18356, 18382

**MASS TRANSPORTATION**
17926, 17960

**MASSACHUSETTS**
18299, 18432

**MATHEMATICAL ANALYSES**
17908, 17915, 17918, 17976, 17998, 18003, 18024, 18030, 18046, 18092, 18136, 18152, 18157, 18174, 18203, 18209, 18211, 18232, 18278, 18292, 18293, 18294, 18296, 18297, 18304, 18311, 18314, 18321, 18324, 18332, 18341, 18355, 18357, 18362, 18365, 18367, 18368, 18372, 18375, 18381, 18389, 18453, 18462, 18486, 18487, 18489, 18503

MATHEMATICAL MODELING
17915, 18003, 18030, 18294, 18297, 18311, 18314, 18321, 18324, 18355, 18357, 18362, 18462, 18487, 18503

MAXIMUM ALLOWABLE CONCENTRATION
17912, 17948, 17961, 17968, 18183, 18209, 18218, 18232, 18261, 18407, 18484, 18485, 18489, 18505

MEDICAL FACILITIES
18397

MEDICAL PERSONNEL
18384, 18397, 18529

MEETINGS
18297, 18407, 18495, 18496, 18515

MEMBRANE FILTERS
18100, 18111, 18121, 18142, 18147, 18175, 18198, 18200, 18215

MEMBRANES
18407, 18427

MERCAPTANS
17930, 17966, 18065, 18101, 18258, 18438

MERCURY COMPOUNDS
17951, 18040, 18165, 18390, 18411, 18414, 18417, 18433, 18453, 18463, 18533

METABOLISM
18388, 18391, 18397, 18414, 18416, 18417, 18423, 18457, 18459, 18463, 18466, 18467, 18472, 18473, 18484

METAL COMPOUNDS
17912, 17917, 17923, 17930, 17932, 17939, 17943, 17951, 17953, 17955, 17958, 17961, 17970, 17975, 17979, 17981, 17987, 17991, 18002, 18016, 18023, 18024, 18026, 18040, 18047, 18052, 18057, 18058, 18059, 18070, 18071, 18078, 18080, 18082, 18083, 18088, 18091, 18112, 18114, 18116, 18137, 18148, 18159, 18160, 18165, 18171, 18184, 18194, 18198, 18206, 18242, 18245, 18246, 18247, 18250, 18251, 18252, 18262, 18263, 18264, 18265, 18266, 18267, 18270, 18272, 18284, 18289, 18294, 18299, 18318, 18322, 18334, 18341, 18356, 18359, 18369, 18370, 18371, 18373, 18387, 18390, 18391, 18393, 18395, 18396, 18397, 18398, 18399, 18405, 18406, 18411, 18412, 18414, 18417, 18420, 18423, 18433, 18435, 18436, 18443, 18448, 18451, 18452, 18453, 18454, 18462, 18463, 18473, 18474, 18475, 18484, 18485, 18487, 18495, 18498, 18526, 18533

METAL FABRICATING AND FINISHING
17906, 17985, 17990, 18045, 18066, 18073, 18215, 18406, 18411, 18459, 18496, 18497

METAL POISONING
17961, 18390, 18393, 18396, 18397, 18398, 18399, 18405, 18406, 18414, 18423, 18433, 18435, 18451, 18452, 18453, 18533

METALS
17906, 17920, 17955, 17973, 17976, 17982, 17985, 17986, 17995, 18005, 18021, 18044, 18062, 18066, 18088, 18102, 18114, 18116, 18118, 18140, 18146, 18208, 18245, 18272, 18359, 18379, 18388, 18406, 18411, 18461, 18475, 18485, 18496

METEOROLOGICAL INSTRUMENTS
18123, 18277, 18283, 18290, 18293, 18300, 18311, 18317, 18326, 18349

METEOROLOGY
17908, 17909, 17912, 17936, 17939, 17942, 17979, 18012, 18046, 18054, 18066, 18085, 18101, 18102, 18111, 18123, 18124, 18125, 18150, 18167, 18172, 18186, 18215, 18218, 18221, 18223, 18225, 18226, 18229, 18234, 18235, 18236, 18237, 18238, 18239, 18240, 18242, 18247, 18256, 18261, 18264, 18265, 18271, 18273, 18274, 18275, 18276, 18277, 18278, 18279, 18280, 18281, 18282, 18283, 18284, 18286, 18287, 18288, 18289, 18290, 18291, 18293, 18294, 18295, 18296, 18297, 18298, 18299, 18300, 18302, 18303, 18304, 18306, 18308, 18310, 18312, 18313, 18315, 18316, 18317, 18319, 18320, 18321, 18323, 18324, 18325, 18327, 18328, 18329, 18330, 18331, 18332, 18335, 18336, 18337, 18338, 18339, 18340, 18341, 18342, 18343, 18345, 18346, 18347, 18348, 18349, 18350, 18351, 18352, 18353, 18354, 18373, 18386, 18400, 18401, 18410, 18419, 18431, 18455, 18469, 18470, 18471, 18475, 18487, 18490, 18521, 18501, 18503, 18504, 18518, 18533

METHANES
17948, 17950, 17983, 18205, 18408

MEUSE VALLEY
18291

MICE
18394, 18408, 18409, 18417, 18432, 18438

MICHIGAN
17906, 18454

MICROMETEOROLOGY
18046, 18261, 18277, 18288, 18290, 18323, 18331, 18490

MICROORGANISMS
18082, 18119, 18121, 18240, 18271, 18440, 18441, 18458, 18470

MICROSCOPY
18029, 18312, 18341

MIDDLE ATMOSPHERE
18282, 18294, 18297, 18305, 18349

MILK
17912, 18218

MINERAL PROCESSING
17911, 17912, 17936, 17962, 17976, 17986, 18053, 18076, 18116, 18390, 18405, 18443, 18496, 18513

MINING
17936, 18390, 18443

MISSOURI
18265, 18425

MISTS
17916, 17924, 17982, 18084, 18146, 18147, 18170, 18175, 18180, 18334, 18485

MOLYBDENUM COMPOUNDS
18026

MONITORING
17908, 17911, 17950, 17972, 18044, 18122, 18123, 18124, 18126, 18139, 18149, 18152, 18153, 18154, 18161, 18165, 18166, 18173, 18180, 18188, 18199, 18200, 18205, 18206, 18207, 18214, 18218, 18223, 18227, 18228, 18249, 18256, 18287, 18363, 18396, 18399, 18406, 18411, 18438, 18505

MONTHLY
18218, 18219, 18222, 18225, 18226, 18229, 18240, 18260, 18261, 18274, 18294, 18299, 18303, 18313, 18351, 18401

MORBIDITY
18394, 18400, 18407, 18408, 18418, 18421, 18425, 18429, 18431, 18433, 18521

MORTALITY
18291, 18400, 18401, 18402, 18403, 18407, 18408, 18409, 18418, 18419, 18421, 18429, 18431, 18433, 18437, 18438, 18439, 18442, 18444, 18454, 18521

MUTATIONS
18404, 18408, 18441, 18456

N

NAPHTHALENES
17928, 18377

NATIONAL AIR SAMPLING NETWORK (NASN)
18227

NATURAL GAS
17913, 17939, 17940, 17957, 17960, 17968, 18039, 18105, 18295, 18501, 18514

NECROSIS
18468, 18472

NERVOUS SYSTEM
18390, 18393, 18396, 18397, 18399, 18417, 18433, 18435, 18447

NEUTRON ACTIVATION ANALYSIS
18160, 18165, 18272

NEW HAMPSHIRE
18410

NEW YORK CITY
17968, 18300, 18432, 18509, 18524

NEW YORK STATE
17968, 18299, 18300, 18432, 18509, 18524

NICKEL
17920

NICKEL COMPOUNDS
17932, 17981, 18246, 18250, 18251, 18252, 18318, 18371, 18411

NITRATES
17975, 18171, 18185, 18194, 18202, 18250, 18274, 18382, 18458

NITRIC ACID
17957, 18048

NITRIC OXIDE (NO)
17957, 17967, 17980, 17999, 18033, 18048, 18057, 18058, 18067, 18079, 18112, 18126, 18139, 18162, 18170, 18171, 18178, 18191, 18204, 18222, 18249, 18264, 18305, 18306, 18311, 18313, 18321, 18339, 18361, 18485, 18487, 18512

NITRITES
18171, 18194, 18382

NITROGEN
17914, 18098, 18100, 18205, 18301, 18311, 18361, 18473

NITROGEN DIOXIDE (NO2)
17925, 17957, 17980, 18034, 18048, 18126, 18139, 18159, 18162, 18166, 18170, 18171, 18177, 18178, 18182, 18186, 18191, 18193, 18202, 18204, 18206, 18209, 18222, 18249, 18263, 18264, 18305, 18306, 18313, 18321, 18339, 18358, 18382, 18392, 18402, 18409, 18441, 18444, 18445, 18485, 18487

NITROGEN OXIDES
17909, 17924, 17925, 17940, 17946, 17947, 17957, 17958, 17967, 17978, 17980, 17983, 17999, 18023, 18033, 18034, 18047, 18048, 18055, 18057, 18058, 18067, 18068, 18071, 18072, 18075, 18079, 18101, 18104, 18112, 18126, 18139, 18140, 18159, 18162, 18166, 18170, 18171, 18177, 18178, 18182, 18186, 18191, 18193, 18200, 18202, 18204, 18206, 18209, 18222, 18227, 18249, 18263, 18264, 18270, 18274, 18275, 18305, 18306, 18311, 18313, 18321, 18339, 18346, 18358, 18361, 18363, 18382, 18392, 18402, 18409, 18411, 18441, 18444, 18445, 18448, 18485, 18487, 18497, 18504, 18505, 18512

**NITROGEN TRIOXIDE (NO3)**
18339

**NON-INDUSTRIAL EMISSION SOURCES**
17906, 17907, 17909, 17910, 17911, 17912, 17919, 17922, 17934, 17936, 17942, 17944, 17948, 17950, 17951, 17952, 17954, 17957, 17959, 17962, 17968, 17971, 17976, 17985, 17986, 17988, 18008, 18012, 18013, 18015, 18022, 18025, 18070, 18103, 18106, 18218, 18222, 18234, 18254, 18257, 18258, 18295, 18299, 18332, 18370, 18387, 18401, 18405, 18442, 18452, 18457, 18462, 18473, 18475, 18481, 18491, 18492, 18496, 18501, 18505, 18508, 18509, 18511, 18512, 18514, 18527, 18531, 18533, 17964

**NON-URBAN AREAS**
17922, 17942, 17981, 18218, 18230, 18231, 18234, 18246, 18266, 18290, 16299, 18335, 18403, 18407, 18425, 18427, 18436, 18451

**NORTH CAROLINA**
18532

**NOSTRILS**
18384

**NUCLEAR POWER PLANTS**
17913, 17929, 17963, 18128, 18373

**NUCLEAR POWER SOURCES**
18218

**NUCLEATION**
18172, 18278, 18298, 18308, 18325, 18334, 18341, 18381

O

**OATS**
18458

**OCEANS**
18218, 18330, 18356

**OCTANES**
17943, 17961, 18088, 18526

**ODOR COUNTERACTION**
17952, 17984, 17988, 18054, 18065, 18077, 18106, 18269

**ODORIMETRY**
17977, 18054, 18077, 18131, 18150, 18167, 18244, 18428

**ODORS**
17906, 17911, 17912, 17930, 17950, 17976, 17977, 17984, 17988, 18009, 18054, 18065, 18067, 18077, 18090, 18101, 18106, 18150, 18158, 18167, 18222, 18244, 18258, 18269, 18499

**OHIO**
18266

**OIL BURNERS**
18085, 18257

**OIL RESOURCES**
17968, 18070

**OLEFINS**
17932, 17938, 17943, 18041, 18077, 18141, 18187, 18205, 18241, 18301, 18450

**OPEN BURNING**
17936, 17944, 17976, 18492

**OPEN HEARTH FURNACES**
18102

**OPERATING CRITERIA**
18482, 18487, 18492

**OPERATING VARIABLES**
17908, 17914, 17919, 17931, 17932, 17937, 17940, 17953, 17956, 17958, 17965, 17967, 17974, 17977, 17982, 17983, 17989, 17993, 17996, 17999, 18000, 18002, 18004, 18009, 18018, 18024, 18031, 18032, 18040, 18044, 18047, 18048, 18049, 18053, 18055, 18057, 18058, 18059, 18062, 18065, 18067, 18073, 18078, 18079, 18080, 18084, 18088, 18098, 18099, 18101, 18104, 18108, 18115, 18118, 18144, 18153, 18154, 18155, 18156, 18160, 18184, 18199, 18201, 18355, 18426, 18482, 18518

**OPINION SURVEYS**
18525

**ORCHARDS**
18459, 18468

**OREGON**
18229

**ORGANIC ACIDS**
17912, 18107, 18115, 18444, 18458

**ORGANIC NITROGEN COMPOUNDS**
17947, 18065, 18134, 18269, 18438

**ORGANIC SULFUR COMPOUNDS**
17930, 17966, 17984, 18065, 18082, 18101, 18258, 18408, 18409, 18438, 18477

**ORGANIC WASTES**
17950, 17951, 17988, 18106

**ORGANOMETALLICS**
18165, 18390

**OUTPATIENT VISITS**
18399

**OVERFIRE AIR**
17919

**OXIDANTS**
18141, 18149, 18159, 18187, 18191, 18204, 18209, 18227, 18274, 18275, 18306, 18313, 18316, 18336, 18337, 18338, 18363, 18409, 18445, 18487

**OXIDATION**
17948, 17978, 17992, 18031, 18052, 18070, 18082, 18085, 18162, 18178, 18206, 18280, 18349, 18354, 18357, 18362, 18377, 18434, 18464, 18465, 18466, 18467, 18474, 18477

**OXYGEN**
17914, 17978, 17988, 18031, 18085, 18100, 18151, 18152, 18162, 18306, 18361, 18377, 18380, 18519, 18533

**OZONE**
17924, 18139, 18141, 18149, 18159, 18173, 18177, 18187, 18192, 18204, 18305, 18349, 18354, 18363, 18392, 18409, 18411, 18413, 18455, 18456, 18472, 18476, 18485

**OZONESONDES**
18349

P

**PACKED TOWERS**
17989, 18001, 18018

**PAINTS**
18040, 18244, 18397, 18399, 18452

**PAPER CHROMATOGRAPHY**
17916, 18095, 18131, 18145

**PAPER MANUFACTURING**
17922, 17951, 17952, 18008, 18009, 18015, 18497

**PARIS**
18233, 18524

**PARTICLE COUNTERS**
18030, 18111, 18121, 18144, 18172, 18199, 18248

**PARTICLE GROWTH**
18278, 18298, 18312, 18325, 18341, 18378, 18381

**PARTICLE SHAPE**
18355, 18389

**PARTICLE SIZE**
17961, 17975, 17990, 18010, 18016, 18029, 18030, 18082, 18095, 18097, 18111, 18114, 18119, 18148, 18157, 18211, 18216, 18220, 18236, 18242, 18248, 18278, 18285, 18312, 18329, 18334, 18341, 18364, 18365, 18378, 18381, 18383, 18389, 18440, 18482

**PARTICULATE SAMPLING**
18118, 18121, 18143, 18199, 18207

**PATHOLOGICAL TECHNIQUES**
18392, 18429, 18433, 18438, 18443

**PENNSYLVANIA**
18266, 18418, 18432, 18436, 18532

**PERMEABILITY**
18016, 18100, 18366, 18473, 18483

**PERMITS**
18046, 18494, 18535

**PEROXIDES**
18159, 18380

**PEROXYACETYL NITRATE**
18185, 18202, 18274, 18458

**PEROXYACYL NITRATES**
18185, 18202, 18274, 18458

**PERSONNEL**
18204, 18219, 18257, 18384, 18397, 18524, 18527, 18529

**PERYLENES**
18234, 18255

**PESTICIDES**
17959, 18327, 18330, 18408, 18452, 18462, 18533

**PETER SPENCE PROCESS (CLAUS)**
17996, 18074

**PETROLEUM DISTRIBUTION**
18110

**PETROLEUM PRODUCTION**
17957, 17976, 18258

**PETROLEUM REFINING**
17936, 17939, 17943, 17957, 17961, 17962, 17970, 17971, 17976, 18002, 18015, 18088, 18101, 18151, 18258, 18274, 18385, 18496, 18526

**PH**
17939, 18021, 18063, 18070, 18076, 18085, 18147, 18171, 18175, 18370, 18420, 18462

**PHENANTHRENES**
17928

**PHENOLS**
17912, 18069, 18169, 18444

**PHENYL COMPOUNDS**
18244, 18380

**PHENYLS**
18244

**PHILADELPHIA**
18266, 18436

**PHOSPHORUS COMPOUNDS**
18063, 18068, 18160, 18294

**PHOTOCHEMICAL REACTIONS**
17924, 17925, 18301, 18306, 18307, 18311, 18316, 18337, 18349, 18363, 18377, 18380, 18382

**PHOTOELECTRIC PHENOMENA**
18146, 18147, 18161, 18361, 18377

**PHOTOGRAPHIC METHODS**
17933, 17946, 18122, 18373

**PHOTOLYSIS**
18363

**PHOTOMETRIC METHODS**
18120, 18122, 18124, 18128, 18138, 18181, 18199, 18227, 18231, 18236, 18248, 18254, 18464, 18465

**PHOTOOXIDATION**
18377, 18380

**PHOTOSYNTHESIS**
18457, 18459, 18461, 18466, 18467, 18473

**PILOT PLANTS**
17907, 17986, 18000, 18018

**PINTO BEANS**
18455

**PITTSBURGH**
18432, 18532

**PLANNING AND ZONING**
17954, 17973, 18019, 18281, 18288, 18307, 18494, 18496, 18504, 18505, 18509

**PLANT DAMAGE**
17912, 17930, 18275, 18391, 18450, 18454, 18458, 18459, 18461, 18463, 18464, 18465, 18468, 18470, 18472, 18473, 18490

**PLANT GROWTH**
18241, 18450, 18455, 18457, 18458, 18459, 18461, 18466, 18467, 18473

**PLASTICS**
17927, 17938, 18012, 18131, 18142

**PLATINUM**
18088, 18140

**PLETHYSMOGRAPHY**
18412, 18426, 18430

**PLUME BEHAVIOR**
18152, 18239, 18277, 18279, 18280, 18286, 18293, 18296, 18300, 18329, 18345, 18346, 18347, 18501, 18503

**PLUTONIUM COMPOUNDS**
18016

**PNEUMOCONIOSIS**
18388

**POINT SOURCES**
18332, 18342

**POLAROGRAPHIC METHODS**
18173, 18210, 18246, 18256

**POLLEN COLLECTORS**
18329

**POLLENS**
18329

**POLYMERIZATION**
17916, 18457

**POLYNUCLEAR COMPOUNDS**
17928, 18042, 18127, 18132, 18135, 18145, 18176, 18234, 18254, 18255, 18377, 18380, 18408

**POTASSIUM COMPOUNDS**
17912, 18159, 18299, 18473

**POTENTIOMETRIC METHODS**
17966, 18125, 18149, 18161

**POWER SOURCES**
17913, 17915, 17920, 17921, 17925, 17926, 17931, 17932, 17935, 17937, 17946, 17949, 17956, 17957, 17960, 17967, 17969, 17972, 17977, 17978, 17983, 17993, 17994, 17995, 17999, 18013, 18014, 18023, 18024, 18039, 18042, 18056, 18057, 18058, 18067, 18079, 18104, 18109, 18112, 18113, 18133, 18152, 18153, 18203, 18218, 18295, 18362, 18387, 18443, 18452, 18474, 18479, 18533

**PRECIPITATION**
17939, 17979, 18150, 18218, 18234, 18240, 18273, 18280, 18282, 18289, 18294, 18298, 18299, 18323, 18325, 18327, 18331, 18346, 18347, 18353

**PRESSURE (ATMOSPHERIC)**
18284, 18302, 18320, 18324, 18338, 18343, 18347, 18348, 18351, 18501, 18503

**PRIMARY METALLURGICAL PROCESSING**
17945, 17962, 17971, 17973, 17976, 17978, 17985, 17986, 17990, 18015, 18044, 18062, 18098, 18102, 18118, 18161, 18245, 18272, 18388, 18405, 18461, 18496

**PRIMATES**
18438

**PRINTING**
17916

**PROCESS MODIFICATION**
17910, 17919, 17937, 17940, 17942, 17950, 17957, 17985, 17993, 18003, 18009, 18015, 18032, 18050, 18057, 18058, 18067, 18076, 18093, 18101, 18104, 18113, 18201, 18203, 18257

**PROPANES**
17910, 17914, 17960, 17983, 18249, 18308

**PROPENES**
17932

**PROPIONALDEHYDES**
18269

**PROPOSALS**
18286, 18297, 18484

**PROTEINS**
18395, 18396, 18398, 18457, 18459, 18472, 18473

**PUBLIC AFFAIRS**
17973, 18219, 18224, 18244, 18245, 18354, 18385, 18404, 18407, 18498, 18505, 18508, 18510, 18514, 18525, 18529, 18530, 18532, 17964

**PUBLIC INFORMATION**
18354, 18404, 18407, 18498, 18510, 18525, 18529, 18532

**PULMONARY EDEMA**
18413

**PULMONARY FUNCTION**
18263, 18384, 18385, 18410, 18412, 18415, 18426, 18427, 18430

**PULMONARY RESISTANCE**
18412, 18427, 18430

**PYRENES**
17928, 18042, 18127, 18135, 18176, 18234, 18254, 18255, 18408

**PYROLYSIS**
17927, 17938, 18078, 18135, 18212

Q

**QUARTZ**
18030, 18142, 18208, 18355

**QUENCHING**
18079

**QUESTIONNAIRES**
18385

R

**RABBITS**
18422, 18438

**RADIATION COUNTERS**
18030, 18040

**RADIATION MEASURING SYSTEMS**
18030, 18040, 18198, 18199, 18218, 18272, 18292

**RADIOACTIVE RADIATION**
17929, 18012, 18030, 18040, 18128, 18160, 18198, 18199, 18218, 18242, 18282, 18292, 18294, 18298, 18325, 18373, 18395, 18443, 18456, 18462, 18475

**RADIOACTIVE TRACERS**
18030, 18040, 18128, 18282, 18292, 18298, 18325, 18395

**RADIOGRAPHY**
18385, 18393

**RADIOSONDES**
18349

**RADON**
18282, 18443

**RAGWEED**
18329

**RAIN**
18150, 18218, 18240, 18280, 18282, 18299, 18323, 18325, 18346, 18353

**RAPPING**
18096

**RATS**
18392, 18395, 18435, 18438, 18447

**REACTION KINETICS**
17918, 17937, 17938, 17947, 17974, 18029, 18031, 18049, 18078, 18083, 18162, 18171, 18284, 18301, 18305, 18357, 18358, 18379

**REACTION MECHANISMS**
17924, 17937, 17940, 18010, 18078, 18098, 18115, 18166, 18305, 18309, 18311, 18358, 18359, 18377, 18379, 18409, 18416, 18458

**REACTORS (NUCLEAR)**
17963, 18128, 18373

**RECOMBINATION**
18311

**RECORDING METHODS**
17933, 17946, 18122, 18123, 18166, 18203, 18227, 18342, 18373, 18427

**REDUCTION**
18048, 18083, 18115, 18194, 18305, 18359

**REGIONAL GOVERNMENTS**
18503

**REGULATIONS**
17929, 17943, 18019, 18046, 18110, 18113, 18332, 18478, 18484, 18493, 18500, 18502, 18505, 18508, 18509, 18517, 18520, 18531

**REINLUFT PROCESS (ADSORPTION)**
18074

**RENDERING**
18167, 18269

**REPRODUCTION**
18387, 18408, 18444, 18467

**RESEARCH INSTITUTES**
17952, 18165, 18349, 18407, 18532

**RESEARCH METHODOLOGIES**
18204, 18407, 18416, 18430

**RESEARCH PROGRAMS**
17962, 17976, 18011, 18038, 18082, 18113, 18277, 18309, 18491, 18497, 18498, 18515, 18518, 18525

**RESIDENTIAL AREAS**
17959, 17973, 18022, 18222, 18246, 18252, 18256, 18257, 18266, 18274, 18288, 18343, 18446, 18505, 18509

**RESIDUAL OILS**
17947, 17968, 18000, 18078, 18093, 18107, 18108, 18251, 18273, 18509, 18523

**RESPIRATORY DISEASES**
18291, 18354, 18384, 18386, 18388, 18392, 18403, 18407, 18410, 18413, 18415, 18418, 18419, 18424, 18425, 18430, 18431, 18437, 18442, 18443, 18444, 18445, 18521

**RESPIRATORY SYSTEM**
17961, 18384, 18386, 18389, 18391, 18392, 18394, 18407, 18423, 18425, 18427, 18439, 18440, 18441, 18444, 18445, 18446

**RETENTION**
17979, 18370, 18396, 18451, 18461, 18462

**RINGELMANN CHART**
18207

**RIVERS**
18218, 18323, 18330

**RUBBER**
17912, 18012, 18476

**RUBBER MANUFACTURING**
17936, 18476

S

**SAFETY EQUIPMENT**
17983

**SALTZMAN METHOD**
18140, 18162, 18166, 18177, 18178, 18191, 18275, 18339

**SAMPLERS**
18035, 18100, 18111, 18118, 18121, 18142, 18147, 18148, 18164, 18173, 18175, 18184, 18188, 18198, 18200, 18204, 18207, 18208, 18214, 18215, 18216, 18242, 18245, 18246, 18250, 18251, 18252, 18254, 18255, 18262, 18265, 18267, 18271, 18282, 18312, 18318, 18322, 18329, 18410, 18482, 18503

**SAMPLING PROBES**
17914, 17972, 17975

**SANITARIANS**
18257, 18397

**SCATTERING (ATMOSPHERIC)**
18278, 18285, 18288, 18319, 18331

**SCREEN FILTERS**
17982, 18087

**SCRUBBERS**
17907, 17945, 17982, 17985, 17988, 17989, 17991, 17994, 18001, 18004, 18005, 18006, 18013, 18017, 18018, 18019, 18020, 18028, 18051, 18059, 18060, 18061, 18063, 18066, 18072, 18073, 18080, 18089, 18097, 18101, 18103, 18104, 18105, 18117, 18118, 18191, 18201, 18207, 18208, 18499, 18503

**SEA BREEZE**
18316, 18317, 18336, 18337, 18348

**SECONDARY AIR**
18009, 18201

**SEDIMENTATION**
17986, 18013, 18020, 18030, 18082, 18091, 18216, 18219, 18271, 18356, 18375, 18389

**SELENIUM COMPOUNDS**
18210

**SETTLING CHAMBERS**
18013, 18020

**SETTLING PARTICLES**
17906, 17907, 17911, 17912, 17919, 17934, 17936, 17937, 17962, 17965, 17971, 17976, 17981, 17986, 17990, 17991, 18006, 18011, 18017, 18019, 18021, 18022, 18028, 18030, 18038, 18044, 18045, 18051, 18053, 18060, 18064, 18066, 18067, 18072, 18081, 18084, 18086, 18087, 18090, 18092, 18094, 18095, 18096, 18101, 18103, 18111, 18116, 18119, 18120, 18121, 18132, 18142, 18153, 18170, 18201, 18207, 18208, 18214, 18215, 18216, 18219, 18220, 18222, 18223, 18226, 18227, 18236, 18245, 18257, 18274, 18289, 18306, 18330, 18339, 18353, 18394, 18432, 18437, 18443, 18460, 18462, 18482, 18485, 18492, 18533

**SEWAGE**
17948, 17988, 18234, 18258, 18491, 18512

**SEWAGE TREATMENT**
18258, 18512

**SHIPS**
18295, 18496

**SIEVE ANALYSIS**
18482

**SILICON COMPOUNDS**
18072, 18420

**SILICON DIOXIDE**
18114, 18475

**SILICOSIS**
18388

**SILVER COMPOUNDS**
18341

**SIMULATION**
17928, 18003, 18010, 18079, 18135, 18307, 18332, 18345, 18357, 18426

**SINTERING**
17986, 18078

**SKIN**
18407, 18427

**SKIN CANCER**
18394

**SLAUGHTERHOUSES**
17911

**SLUDGE**
17948, 17988, 18491

**SMOG**
18061, 18261, 18306, 18316, 18336, 18337, 18349, 18418, 18431

**SMOKE SHADE**
17993, 18120, 18124, 18153, 18154, 18207, 18221, 18257, 18373

**SMOKEMETERS**
17977, 18133, 18153, 18201

**SMOKES**
17906, 17910, 17918, 17924, 17927, 17928, 17936, 17937, 17944, 17971, 17973, 17977, 17993, 18004, 18006, 18011, 18012, 18022, 18038, 18061, 18067, 18094, 18101, 18104, 18119, 18120, 18124, 18127, 18128, 18129, 18135, 18145, 18153, 18161, 18226, 18229, 18291, 18295, 18334, 18345, 18419, 18442, 18444, 18492, 18521

**SMOKING**
17928, 17936, 18127, 18135, 18266, 18403, 18410, 18421, 18422, 18425, 18428, 18439, 18442, 18443, 18444, 18448

**SNOW**
17979, 18234

**SOCIAL ATTITUDES**
17909, 17929, 18524, 18528, 18530, 18531, 18532

**SOCIO-ECONOMIC FACTORS**
17942, 17959, 17983, 18014, 18072, 18397, 18399, 18478, 18479, 18481, 18503, 18511, 18516, 18524, 18526, 18528

**SODIUM CARBONATE**
17930, 18059

**SODIUM CHLORIDE**
18016, 18284, 18289, 18412

**SODIUM COMPOUNDS**
17930, 17932, 18016, 18059, 18070, 18083, 18160, 18171, 18284, 18289, 18299, 18334, 18373, 18412

**SODIUM HYDROXIDE**
18059, 18171

**SODIUM SULFITE**
18070

**SOILING**
17976, 18480

**SOILS**
17912, 17979, 17981, 18218, 18234, 18310, 18405, 18450, 18462, 18527

**SOLAR RADIATION**
17921, 18040, 18202, 18288, 18294, 18319, 18320, 18328, 18331, 18457, 18464, 18521

**SOLID WASTE DISPOSAL**
17906, 17907, 17919, 17950, 17951, 17952, 17957, 17959, 17971, 17976, 17985, 17986, 17988, 18012, 18015, 18022, 18070, 18106, 18475, 18492, 18496, 18511, 18514, 18531

**SOLIDS**
17995, 18172, 18280, 18298, 18308, 18319, 18376

**SOLVENT REFINING (LOW ASH)**
17907, 18082

**SOLVENTS**
17916, 18027, 18032, 18117, 18381

**SOOT**
17937, 17962, 17991, 18022, 18067, 18081, 18103, 18132, 18153, 18201, 18207, 18220, 18222, 18226, 18257

**SOURCE SAMPLING**
18118, 18129, 18150, 18161, 18200, 18208, 18257, 18499

**SO2 REMOVAL (COMBUSTION PRODUCTS)**
17939, 17945, 17982, 17989, 17991, 17996, 18009, 18021, 18029, 18043, 18059, 18069, 18070, 18074, 18080, 18083, 18084, 18085, 18105, 18107, 18115, 18117, 18497, 18503, 18509, 17964

**SPACECRAFT ATMOSPHERES**
18155

SPARK IGNITION ENGINES
17915, 17949, 18057

SPARK TIMING
17983, 17999, 18023, 18058, 18067, 18362

SPECTROMETRY
17972, 18107, 18127, 18129, 18132, 18142, 18143, 18155, 18165, 18186, 18242, 18246, 18247, 18250, 18251, 18252, 18253, 18259, 18262, 18267, 18270, 18285, 18311, 18318, 18356, 18361, 18374, 18382, 18411

SPECTROPHOTOMETRY
18077, 18079, 18126, 18132, 18135, 18165, 18166, 18168, 18169, 18185, 18191, 18206, 18213, 18217, 18250, 18265, 18371, 18382, 18436

SPORES
18240, 18271, 18470

SPRAY TOWERS
17991, 18036, 18051, 18073

ST LOUIS
18265, 18425

STABILITY (ATMOSPHERIC)
17936, 18226, 18239, 18261, 18280, 18281, 18288, 18290, 18291, 18293, 18295, 18300, 18302, 18310, 18328, 18340, 18345, 18346, 18347, 18348, 18401, 18418, 18431, 18521, 18501, 18503

STACK GASES
17906, 17909, 17912, 17939, 17940, 17945, 17947, 17951, 17957, 17973, 17982, 17986, 17989, 17991, 17993, 17996, 18001, 18005, 18006, 18009, 18010, 18011, 18012, 18013, 18015, 18018, 18021, 18022, 18029, 18032, 18043, 18046, 18048, 18049, 18052, 18059, 18061, 18069, 18070, 18074, 18080, 18081, 18083, 18084, 18086, 18089, 18098, 18101, 18102, 18105, 18116, 18117, 18118, 18124, 18126, 18138, 18148, 18151, 18154, 18162, 18170, 18178, 18184, 18186, 18199, 18208, 18224, 18245, 18257, 18280, 18286, 18291, 18295, 18350, 18439, 18459, 18475, 18485, 18489, 18496, 18499, 18503, 18508, 18509, 18523, 18532, 17964

STACK SAMPLING
18118, 18129, 18200, 18208, 18257, 18499

STACKS
17909, 17954, 18005, 18035, 18046, 18084, 18085, 18086, 18097, 18101, 18138, 18279, 18280, 18286, 18296, 18317, 18332, 18492, 18496, 18501, 18503, 18509, 18523, 18525

STAGNATION
18302, 18418, 18501

STATE GOVERNMENTS
18260, 18261, 18484, 18488, 18490, 18502, 18506, 18510, 18515, 18517, 18529

STATISTICAL ANALYSES
17908, 17949, 17959, 18029, 18227, 18228, 18237, 18260, 18261, 18265, 18268, 18281, 18304, 18340, 18352, 18354, 18401, 18403, 18415, 18419, 18442, 18465, 18480, 18501

STEAM
18031, 18078, 18102, 18154

STEAM ENGINES
17926, 17969, 18112, 18479

STEAM PLANTS
17909, 17913, 17929

STEEL
17973, 17976, 17982, 17985, 17986, 18021, 18062, 18066, 18102, 18208, 18496

STONE
17976

STORAGE BATTERIES
17913, 17920, 17926, 17932, 17995, 18109, 18112, 18452

STREETS
17908, 17910, 17926, 17933, 17935, 17941, 17958, 17979, 18133, 18233, 18235, 18238, 18246, 18253, 18259, 18265, 18270, 18307, 18314, 18394, 18432, 18446

STRONTIUM COMPOUNDS
18160

STUDENTS
18204, 18219

STYRENES
18244

SUBLIMATION
18308

SULFATES
17930, 17987, 18059, 18063, 18070, 18083, 18105, 18175, 18250, 18275, 18284, 18289, 18299, 18322, 18334, 18353, 18386, 18477, 18487

SULFIDES
17924, 17930, 17966, 17982, 17996, 18001, 18009, 18027, 18039, 18040, 18043, 18059, 18069, 18078, 18082, 18083, 18091, 18098, 18099, 18101, 18105, 18115, 18117, 18134, 18158, 18159, 18200, 18217, 18258, 18269, 18275, 18379, 18415, 18438, 18477

SULFITES
17982

SULFONIC ACID
18107

SULFUR COMPOUNDS
17924, 17930, 17932, 17934, 17945, 17966, 17982, 17984, 17987, 17996, 18000, 18001, 18009, 18027, 18039, 18040, 18043, 18059, 18063, 18069, 18070, 18077, 18078, 18082, 18083, 18091, 18093, 18098, 18099, 18101, 18105, 18108, 18115, 18117, 18134, 18158, 18159, 18175, 18200, 18217, 18250, 18258, 18269, 18275, 18284, 18289, 18294, 18299, 18322, 18334, 18353, 18379, 18386, 18408, 18409, 18415, 18438, 18468, 18477, 18487, 18514

SULFUR DIOXIDE
17911, 17912, 17924, 17930, 17951, 17959, 17962, 17968, 17980, 18010, 18014, 18046, 18059, 18063, 18067, 18070, 18072, 18080, 18098, 18123, 18129, 18159, 18161, 18186, 18193, 18196, 18200, 18204, 18206, 18221, 18222, 18224, 18225, 18228, 18230, 18231, 18232, 18237, 18239, 18243, 18249, 18256, 18258, 18261, 18263, 18264, 18268, 18273, 18274, 18275, 18277, 18279, 18280, 18284, 18287, 18291, 18295, 18300, 18301, 18303, 18304, 18306, 18315, 18316, 18318, 18321, 18322, 18331, 18340, 18342, 18343, 18344, 18346, 18350, 18351, 18352, 18353, 18354, 18357, 18369, 18379, 18383, 18386, 18388, 18410, 18412, 18419, 18427, 18457, 18459, 18463, 18464, 18465, 18466, 18467, 18468, 18471, 18473, 18485, 18487, 18492, 18496, 18501, 18505

SULFUR OXIDES
17909, 17911, 17912, 17924, 17930, 17934, 17939, 17951, 17959, 17962, 17968, 17980, 17987, 18010, 18011, 18014, 18046, 18059, 18063, 18067, 18070, 18072, 18080, 18085, 18098, 18101, 18107, 18117, 18123, 18129, 18159, 18161, 18168, 18180, 18186, 18188, 18193, 18196, 18200, 18204, 18206, 18209, 18221, 18222, 18224, 18225, 18226, 18227, 18228, 18230, 18231, 18232, 18237, 18239, 18243, 18249, 18256, 18258, 18261, 18263, 18264, 18268, 18273, 18274, 18275, 18277, 18279, 18280, 18284, 18286, 18287, 18291, 18295, 18300, 18301, 18302, 18303, 18304, 18306, 18313, 18315, 18316, 18318, 18320, 18321, 18322, 18331, 18340, 18342, 18343, 18344, 18346, 18350, 18351, 18352, 18353, 18354, 18357, 18369, 18379, 18383, 18386, 18388, 18410, 18412, 18419, 18427, 18437, 18457, 18459, 18463, 18464, 18465, 18466, 18467, 18468, 18471, 18473, 18485, 18487, 18490, 18492, 18496, 18497, 18501, 18505, 18523

SULFUR OXIDES CONTROL
17907, 17939, 17945, 17982, 17989, 17991, 17996, 17997, 18000, 18009, 18013, 18021, 18026, 18029, 18043, 18059, 18062, 18069, 18070, 18074, 18078, 18080, 18082, 18083, 18084, 18085, 18105, 18107, 18108, 18115, 18117, 18477, 18497, 18503, 18509, 17964

SULFUR TRIOXIDE
17924, 17987, 18080, 18085, 18180, 18188, 18237, 18273, 18303, 18437, 18468

SULFURIC ACID
17939, 17945, 18070, 18074, 18084, 18105, 18146, 18147, 18175, 18188, 18284, 18334, 18342, 18353, 18354, 18386, 18459, 18468, 18485

SUPERCOOLING
18308

SURFACE COATING OPERATIONS
17910, 17912, 18244

SURFACE COATINGS
17912, 17916, 17927, 18040, 18244, 18379, 18397, 18399, 18406, 18452

SURFACE PROPERTIES
17916, 17998, 18018, 18026, 18360, 18366, 18379, 18474

SURFACTANTS
18073, 18077

SURVEY METHODS
18219, 18221, 18225, 18226, 18307

SUSPENDED PARTICULATES
17906, 17909, 17910, 17916, 17918, 17924, 17927, 17928, 17936, 17937, 17944, 17945, 17962, 17971, 17973, 17977, 17981, 17982, 17989, 17993, 18004, 18006, 18011, 18012, 18015, 18019, 18021, 18022, 18032, 18038, 18041, 18061, 18067, 18080, 18081, 18084, 18086, 18092, 18094, 18101, 18104, 18114, 18119, 18120, 18124, 18127, 18128, 18129, 18135, 18145, 18146, 18147, 18148, 18153, 18161, 18170, 18175, 18180, 18188, 18210, 18215, 18220, 18224, 18226, 18227, 18229, 18246, 18247, 18249, 18251, 18252, 18261, 18264, 18267, 18278, 18291, 18295, 18306, 18316, 18329, 18334, 18336, 18337, 18345, 18349, 18362, 18375, 18381, 18385, 18410, 18417, 18418, 18419, 18431, 18442, 18443, 18444, 18462, 18485, 18492, 18521, 18509, 18513

SWEDEN
17951, 17952, 17979, 17987, 18005

SYNERGISM
18383, 18391, 18392, 18425, 18440, 18441, 18442, 18443, 18444, 18456, 18458, 18459

SYNTHETIC FIBERS
18207

SYNTHETIC RUBBER
17912

T

TAR
18176, 18394, 18432

**TAXATION**
18502, 18517

**TECHNICAL SOCIETIES**
17990, 18515, 18529

**TEMPERATURE**
17908, 17915, 17916, 17925, 17937, 17938, 17940, 17947, 17967, 17974, 17978, 17996, 18001, 18003, 18009, 18010, 18023, 18027, 18029, 18031, 18032, 18035, 18037, 18042, 18049, 18051, 18052, 18053, 18061, 18070, 18078, 18084, 18085, 18093, 18098, 18106, 18111, 18112, 18129, 18130, 18135, 18151, 18154, 18171, 18188, 18201, 18206, 18207, 18208, 18215, 18362, 18367, 18379, 18474, 18475

**TEMPERATURE (ATMOSPHERIC)**
17908, 18123, 18150, 18276, 18279, 18284, 18288, 18298, 18300, 18310, 18313, 18316, 18319, 18323, 18324, 18328, 18337, 18339, 18349, 18351, 18352, 18354, 18400, 18401, 18501, 18503, 18533

**TEMPERATURE GRADIENT**
18226, 18290, 18293, 18300, 18328, 18347

**TEMPERATURE SENSING INSTRUMENTS**
18041, 18125, 18277, 18482

**TENNESSEE**
18219

**TEST ENGINES**
17923, 17937, 18024, 18057, 18079

**TETRAETHYL LEAD**
17917, 17961, 18246

**TEXTILE MANUFACTURING**
18015

**TEXTILES**
18207

**THERMAL RADIATION**
17929, 17963, 17985, 18020, 18082, 18132, 18319, 18328, 18331, 18332, 18381, 18411

**THERMISTORS**
18125

**THERMOCOUPLES**
18041, 18482

**THERMODYNAMICS**
17918, 17938, 17982, 18003, 18098, 18328, 18381

**THERMOMETERS**
18482

**THIN-LAYER CHROMATOGRAPHY**
18176, 18255

**THRESHOLDS**
17961, 18391, 18402, 18428, 18435, 18438, 18448, 18453, 18490

**THUNDERSTORMS**
18298

**TIMED FUEL INJECTION**
17937, 18057, 18067, 18071

**TIN**
18406

**TIN COMPOUNDS**
18406

**TISSUE CULTURES**
18440, 18441

**TISSUES**
18392, 18396, 18451

**TITANIUM COMPOUNDS**
17981, 18116, 18250, 18411

**TOBACCO**
17928, 18145, 18455

**TOKYO**
17935, 17941, 17957, 17968, 18110, 18202, 18221, 18224, 18225, 18228, 18249, 18251, 18262, 18304, 18307, 18316, 18336, 18338, 18344, 18485, 18513, 18520, 18523

**TOLUENES**
17970, 18027, 18117, 18212, 18244, 18382, 18445

**TOPOGRAPHIC INTERACTIONS**
17911, 17936, 17962, 18046, 18101, 18235, 18254, 18265, 18277, 18288, 18324, 18331, 18336, 18337, 18345, 18347, 18353, 18501, 18504

**TOXIC TOLERANCES**
18409, 18414, 18438, 18451, 18453, 18457, 18459, 18463, 18464, 18465, 18466, 18467, 18473

**TOXICITY**
17912, 17924, 17961, 17976, 18130, 18164, 18194, 18235, 18334, 18354, 18383, 18386, 18387, 18388, 18392, 18393, 18396, 18397, 18398, 18406, 18407, 18414, 18416, 18420, 18435, 18444, 18445, 18447, 18448, 18451, 18453, 18459, 18461, 18462, 18463, 18472, 18484, 18485, 18527

**TRACE ANALYSES**
18029, 18143, 18252, 18371

**TRACERS**
18152, 18282, 18298, 18325

**TRAINS**
17936, 18014

**TRANS-2-BUTENE**
18301

**TRANSPORT**
17924, 18292, 18305, 18325, 18327, 18330, 18332, 18349, 18356, 18462

**TRAPPING**
18152

**TRAPPING (SAMPLING)**
17975, 18136, 18143, 18470

**TREES**
17979, 18454, 18460, 18469

**TRUCKS**
17910, 17913, 17935, 18109

**TUMORS**
18394, 18429, 18432

**TUNNELS**
18432

**TURBIDIMETRY**
18120, 18331

**TURBULENCE (ATMOSPHERIC)**
18256, 18292, 18294, 18305, 18317, 18328, 18331, 18341, 18347, 18460

U

**ULTRASONICS**
18157, 18207, 18277

**ULTRAVIOLET RADIATION**
18186, 18288, 18336, 18337, 18363, 18377

**ULTRAVIOLET SPECTROMETRY**
18132, 18311

**UNITED STATES**
17939, 17973, 18183, 18215, 18400, 18442, 18485, 18491, 18508, 18512, 18513, 18514, 18515, 18524, 18531, 18532, 17964

**UNIVERSITIES**
18532

**UPPER ATMOSPHERE**
18297, 18311

**URANIUM COMPOUNDS**
18443

**URBAN AREAS**
17908, 17911, 17912, 17926, 17933, 17935, 17941, 17942, 17957, 17958, 17959, 17962, 17968, 17971, 17973, 17979, 17981, 17983, 18014, 18022, 18025, 18091, 18110, 18113, 18133, 18150, 18186, 18202, 18204, 18209, 18218, 18220, 18221, 18222, 18223, 18224, 18225, 18226, 18227, 18228, 18229, 18230, 18231, 18233, 18234, 18235, 18236, 18237, 18238, 18240, 18242, 18243, 18244, 18245, 18246, 18247, 18249, 18250, 18251, 18252, 18253, 18254, 18255, 18256, 18257, 18258, 18260, 18261, 18262, 18264, 18265, 18266, 18267, 18268, 18269, 18270, 18271, 18272, 18273, 18274, 18275, 18281, 18287, 18288, 18290, 18295, 18297, 18299, 18300, 18302, 18303, 18304, 18306, 18307, 18313, 18315, 18316, 18317, 18318, 18320, 18328, 18335, 18336, 18338, 18339, 18342, 18343, 18344, 18348, 18351, 18352, 18353, 18354, 18377, 18384, 18385, 18391, 18397, 18401, 18403, 18407, 18424, 18425, 18427, 18431, 18432, 18436, 18437, 18439, 18445, 18446, 18459, 18461, 18485, 18487, 18491, 18493, 18495, 18496, 18499, 18501, 18505, 18508, 18509, 18513, 18519, 18520, 18523, 18524, 18530

**URINALYSIS**
18263, 18385, 18393, 18396, 18405, 18414, 18423, 18438, 18451, 18495

**USSR**
17948, 17966, 18059, 18068, 18069, 18098, 18115, 18116, 18119, 18125, 18164, 18254, 18271, 18278, 18294, 18323, 18328, 18341, 18359, 18374, 18378, 18379, 18381, 18388, 18417, 18435, 18447, 18457, 18463, 18464, 18465, 18466, 18467, 18473, 18477, 18489

**UTAH**
17909, 17944

V

**VALLEYS**
18299, 18323

**VANADIUM COMPOUNDS**
17981, 18250, 18251, 18252, 18262, 18322

**VAPOR PRESSURE**
17916, 18054, 18078

**VAPOR RECOVERY SYSTEMS**
17982, 18050, 18110, 18477

**VAPORS**
18031, 18035, 18040, 18049, 18073, 18078, 18102, 18130, 18154, 18279, 18331, 18341, 18362, 18390, 18406, 18433

**VEGETABLES**
18218, 18455, 18490

**VENTILATION**
17927, 17958, 17980, 17988, 18005, 18114, 18128, 18483

**VENTILATION (PULMONARY)**
18430

**VENTURI SCRUBBERS**
18004, 18059, 18089, 18208

**VERMONT**
18299

VISIBILITY
17909, 17924, 17925, 18120, 18229, 18278, 18298, 18310, 18316, 18324, 18373, 18521, 18506

VISIBLE RADIATION
18285

VOLATILITY
17943, 18054, 18381

VOLCANOES
18186

VOLTAGE
18064, 18161

W

WASHINGTON ≤STATE≥
17907, 18525

WASHINGTON D C
18257, 18524

WASHOUT
18234, 18327, 18346, 18347

WATER
17913, 17914, 17946, 17991, 18098, 18154, 18279, 18298, 18358, 18371

WATER POLLUTION
17907, 17909, 17948, 17951, 17954, 17985, 17986, 18008, 18103, 18218, 18234, 18299, 18332, 18370, 18405, 18481, 18508, 18509, 18511, 18512, 18514, 18527, 18533, 17964

WEATHER FORECASTING
18323

WEATHER MAPS
18320

WEATHER MODIFICATION
18276, 18280, 18288, 18298, 18308, 18319, 18331, 18521

WEST AND GAEKE METHOD
18188, 18206, 18275, 18369

WET CYCLONES
18005, 18208

WETTING
18020, 18059

WHEAT
17979

WIND ROSE
18226, 18503

WINDS
18046, 18054, 18066, 18123, 18150, 18186, 18221, 18225, 18226, 18236, 18237, 18238, 18239, 18240, 18242, 18247, 18256, 18264, 18265, 18275, 18280, 18281, 18283, 18287, 18290, 18293, 18295, 18297, 18303, 18310, 18313, 18315, 18316, 18317, 18320, 18323, 18324, 18329, 18330, 18332, 18335, 18336, 18337, 18339, 18340, 18342, 18343, 18347, 18348, 18349, 18350, 18352, 18353, 18354, 18469, 18501, 18503

WOOD
17927, 17971

X

X-RAYS
18198, 18242, 18456, 18475

XYLENES
17970, 18027, [illegible]

Y

YOKOHAMA
18246, 18252

Z

ZINC
17995

ZINC COMPOUNDS
17912, 17932, 17981, 17991, 18040, 18114, 18267, 18272, 18371, 18411,

# AUTHOR INDEX

## A

**AARONSON T**
THE BLACK BOX.
*17913 APTIC NO. 36802

**ABELES F B**
THE ROLE OF ETHYLENE IN PLANT GROWTH AND DEVELOPMENT.
*18450 APTIC NO. 36205

**AGEIKIN D I**
METHOD AND APPARATUS FOR THE QUANTITATIVE MEASUREMENT OF CERTAIN COMPONENTS OF A GAS MIXTURE.
*18125 APTIC NO. 36801

**AIZAKI M**
AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.
*18499 APTIC NO. 36306

**AIZU T**
ATMOSPHERIC SULFUR OXIDES DETERMINATION BY ATOMIC ABSORPTION METHOD.
18168 APTIC NO. 37205

**ALBIN R C**
GAS PRODUCTION FROM BEEF CATTLE WASTES.
17950 APTIC NO. 36404

**ALEKSANDROV E L**
ON THE GROWTH OF DROPLETS BY CONDENSATION ON HYGROSCOPIC NUCLEI.
*18278 APTIC NO. 36142

**ALKYLATION AND ISOMERIZAT**
ALKYLATIN AND ISOMERIZATION.
17943 APTIC NO. 36535

**ALLAVERDYAN E SH**
NEW ABSORBENTS AND CLASSIFICATION OF METHODS OF REMOVING SULPHUR DIOXIDE FROM INDUSTRIAL GASES.
18069 APTIC NO. 36151

**ALLCROFT R**
LEAD AS A NUTRITIONAL HAZARD TO FARM LIVESTOCK. IV. DISTRIBUTION OF LEAD IN THE VARIOUS TISSUES OF BOVINES AFTER INGESTION OF VARIOUS LEAD COMPOUNDS.
*18451 APTIC NO. 36258

**ALOJ S**
INTRACELLULAR DISTRIBUTION OF LEAD IN THE LIVER AND KIDNEY OF THE RAT.
18395 APTIC NO. 36251

**ALTMANN B G**
WASTE COMBUSTION AFTERBURNER.
*17992 APTIC NO. 36867

**AMBROSE M J**
ZERO EXHAUST VISIBILITY--A GOAL ATTAINED FOR PEAKING GAS TURBINES.
*17993 APTIC NO. 36209

**AMDUR M O**
THE IMPACT OF AIR POLLUTANTS ON PHYSIOLOGIC RESPONSES OF THE RESPIRATORY TRACT.
*18386 APTIC NO. 36255

A COMPARISON OF THE ACUTE EFFECTS OF SO2 ADMINISTERED ALONE OR IN COMBINATION WITH NACL PARTICLES ON THE RESPIRATORY MECHANICS OF HEALTHY ADULTS.
18412 APTIC NO. 36363

**ANDERSON A E**
POWER REQUIREMENTS OF ELECTRIC VEHICLES.
17931 APTIC NO. 36128

**ANDO H**
GAS CHROMATOGRAPHY OF COMBUSTION PRODUCTS.
*17914 APTIC NO. 36898

**ANDO W**
PHOTOCHEMICAL REACTION BETWEEN SO2 AND ORGANIC COMPOUND (III).
18301 APTIC NO. 36483

**ARAI F**
FUNDAMENTAL RESEARCH ON DEODORIZATION BY OXIDATION IN FLUIDIZED BED.
18065 APTIC NO. 37162

**ARAI H**
ON THE MEASUREMENT OF OZONE CONCENTRATION IN THE AIR.
18149 APTIC NO. 36833

**ARASHIDANI K**
SHORT TERM DETERMINATION OF BENZO(A)PYRENE IN TARRY MATERIALS.
18176 APTIC NO. 37215

**ASAKUNO K**
RESEARCH ON REGIONAL REPRESENTABILITY OF SO2 CONCENTRATION.
*18228 APTIC NO. 36805

ON HEAVY METALS IN SUSPENDED PARTICULATE AND LOCAL CHARACTERISTICS IN TOKYO.
18251 APTIC NO. 37191

**ASANO I**
STUDIES ON THE INDUSTRIAL LEAD POISONING. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN HUMAN BEING THROUGH THE RESPIRATORY TRACT.
18423 APTIC NO. 36129

**ASAOKA T**
AIR POLLUTION CAUSED BY EXHAUST GAS OF AUTOMOBILES IN SHIZUOKA PREFECTURE.
18270 APTIC NO. 36909

**ASH J E**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**ASHMORE J W**
APPARATUS FOR PURIFYING EXHAUST FUMES.
*17994 APTIC NO. 36918

**ASKEY W E**
REDESIGN OF EXISTING CATALYTIC REFORMING UNITS FOR OCTANE IMPROVEMENTS.
18002 APTIC NO. 36453

**ASTAKHOV V A**
POTENTIOMETRIC DETERMINATIONS OF THE GROUP COMPOSITION OF SULFUR COMPOUNDS PRESENT IN STRAIGHT-RUN GASOLINE FRACTIONS.
17966 APTIC NO. 36533

**ASTOLFI E**
REALITY OF THE TOXICOLOGICAL PROBLEM IN INFANCY.
*18387 APTIC NO. 36446

**AYNSLEY E**
COOLING TOWERS, THE ENVIRONMENT AND THE FUTURE.
*18279 APTIC NO. 36073

ENVIRONMENTAL ASPECTS OF COOLING TOWER PLUMES.
*18280 APTIC NO. 36147

**AYRES E**
THE ECONOMIC IMPACT OF CONVERSION TO A NONPOLLUTING ATMOSPHERE.
*18479 APTIC NO. 36169

**AZUMA K**
MEASUREMENT OF OXIDES OF NITROGEN BY IODINE PENTOXIDE METHOD.
*18126 APTIC NO. 36546

## B

**BABA H**
A NEW ZINC-AIR FUEL BATTERY SYSTEM.
*17995 APTIC NO. 36143

**BABASHKINA T I**
RECOVERY OF TITANIUM DIOXIDE FROM FLUE GASES WITH METAL CERAMIC FILTERS.
18116 APTIC NO. 36518

**BABCOCK L R JR**
OAK RIDGE AIR QUALITY INDEX.
18209 APTIC NO. 36179

**BABUSHKINA L G**
SOME INDICES OF LIPID METABOLISM IN THE BLOOD OF WORKERS ENGAGED IN COPPER WORKS.
*18388 APTIC NO. 36517

**BAILEY J D**
WASTE COMBUSTION AFTERBURNER.
17992 APTIC NO. 36867

**BANDO S**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
18272 APTIC NO. 36293

**BANERJEE T**
ENVIRONMENTAL CONCENTRATIONS OF SOME OF THE MAJOR INORGANIC POLLUTANTS AT THE BARC SITE, TROMBAY, BOMBAY.
18274 APTIC NO. 36168

AIR POLLUTION STUDIES IN TROMBAY REGION.
18275 APTIC NO. 36237

**BARBER F R**
SULPHUR DIOXIDE CONCENTRATIONS MEASURED AROUND A MODERN POWER STATION.
18239 APTIC NO. 36384

**BARBER J C**
WILL EAGERNESS FOR POLLUTION CONTROL AFFECT FERTILIZER MARKET? Croplife, 1970:25-28, Jan. 1970.
18072 APTIC NO. 36405

SO2 PICKUP BY LIMESTONE AND DOLOMITE PARTICLES IN FLUE GAS.
18010 APTIC NO. 36455

**BARTON R K**
AN EMPIRICAL MODEL FOR CORRELATING CYCLE-BY-CYCLE CYLINDER GAS MOTION AND COMBUSTION VARIATIONS OF A SPARK IGNITION ENGINE.
*17915 APTIC NO. 36127

**BASSEMIR R W**
AVOIDING SOLVENT EMISSIONS-SOLVENTLESS INKS.
*17916 APTIC NO. 36124

**BEAVON D K**
ABATING SULFUR PLANT TAIL GASES.
*17996 APTIC NO. 37156

**BECKER P M**
FLAMES, IONS, AND ELECTRIC FIELDS.
18034 APTIC NO. 36075

**BEECKMANS J M**
THE DEPOSITION OF ASBESTOS PARTICLES IN THE HUMAN RESPIRATORY TRACT.
*18389 APTIC NO. 36269

**BELDING J**
THE HIGH SULFUR COMBUSTOR.
*17997 APTIC NO. 36064

**BELL A G**
ROAD ANTIKNOCK PERFORMANCE OF LOW LEAD AND NONLEADED GASOLINES IN EUROPEAN CARS.
*17917 APTIC NO. 36082

**BENARIE M**
THE EFFECT OF PORE SIZE DISTRIBUTION ON FILTRATION CHARACTERISTICS OF FIBROUS FILTERS.
*17998 APTIC NO. 36216

**BENSON J D**
EFFECTS OF CHARGE DILUTION OF NITRIC OXIDE EMISSION FROM A SINGLE-CYCLINDER ENGINE.
*17999 APTIC NO. 36146

**BENTLEY H R**
POLYNUCLEAR HYDROCARBONS IN TOBACCO AND TOBACCO SMOKE.
*18127 APTIC NO. 36373

**BERG L**
HYDRODESULFURIZATION CATALYST SUPPORT MATERIALS.
18026 APTIC NO. 36189

**BERG N**
TRENDS IN VISIBILITY AT SALEM, OREGON, 1958-1967.
*18229 APTIC NO. 36236

**BERKAU E E**
AN INVESTIGATION OF THE CONVERSION OF VARIOUS FUEL NITROGEN COMPOUNDS TO NITROGEN OXIDES IN OIL COMBUSTION.
17947 APTIC NO. 36126

**BERTI V**
CATALYTIC HYDRODESULFURIZATION OF PETROLEUM RESIDUES: FIXED AND SUSPENSION-BED PROCEDURES.
*18000 APTIC NO. 36525

**BEUKENKAMP J**
THE REMOVAL OF CARBONYL SULPHIDE FROM INDUSTRIAL GASES.
*18001 APTIC NO. 37203

**BHATTACHARYYA N B**
A STUDY OF DESULPHURIZATION OXIDE.
18099 APTIC NO. 36059

**BILLARD F**
USE OF FUMIGENS FOR THE STUDY OF VENTILATION. RECYCLING EVALUATION, MEASUREMENT OF TRANSIT TIME.
*18128 APTIC NO. 36445

**BIONDI C**
THE SYMPTOMATOLOGICAL AND PHYSIOPATHOLOGICAL DIFFERENCES OF INTOXICATIONS BY MERCURY VAPORS AND BY MERCURY COMPOUNDS.
*18390 APTIC NO. 36225

**BISWAS B K**
THE PROBLEM OF SMOKE FORMATION AND CONTROL.
*17918 APTIC NO. 36070

**BLACK E N IV**
REDESIGN OF EXISTING CATALYTIC REFORMING UNITS FOR OCTANE IMPROVEMENTS.
*18002 APTIC NO. 36453

**BLENK M H**
MATH MODELING OF AN EXHAUST REACTOR.
*18003 APTIC NO. 36104

**BOEER W**
THE APPLICATION OF METEOROLOGICAL DATA IN TOWN PLANNING, IN RELATION TO PROBLEMS ON AIR POLLUTION.
*18281 APTIC NO. 36428

**BOOTE R E**
CONSERVATION: (A) MAN AND ENVIRONMENT.
*18528 APTIC NO. 36457

**BORGOS J A**
AUTOMATIC MONITORS OF PARTICULATE MASS EMISSIONS FROM STATIONARY FOSSIL-FUEL COMBUSTION SOURCES.
18199 APTIC NO. 36421

**BOTERMAN H J**
SMOKE FROM INCINERATORS.
*18004 APTIC NO. 36063

**BOTT J**
ZERO EXHAUST VISIBILITY--A GOAL ATTAINED FOR PEAKING GAS TURBINES.
17993 APTIC NO. 36209

**BOUHUYS A**
LOOP FORMATION IN PRESSURE VS. FLOW DIAGRAMS OBTAINED BY BODY PLETHYSMOGRAPHIC TECHNIQUES.
18426 APTIC NO. 36267

**BOUQUIAUX J**
AIR POLLUTION BY SMOKE AND SO2.
*18231 APTIC NO. 36444

AIR POLLUTION BY SMOKE AND SO2.
*18230 APTIC NO. 36234

**BOWDEN D H**
THE EMPHYSEMA PROFILE IN TWO MIDWESTERN CITIES IN NORTH AMERICA.
18425 APTIC NO. 36400

**BRAIN J D**
AN OZONE JOURNAL.
18413 APTIC NO. 36370

**BRANDT M**
COMPOSITION, SIZE AND CONTROL OF AUTOMOTIVE EXHAUST PARTICLATES.
17975 APTIC NO. 37176

**BRASSER L J**
THE PRESENTATION OF MEASUREMENT RESULTS OF AIR POLLUTION CONCENTRATIONS IN RELATION WITH STANDARDS FOR THE RESTRICTION OF THESE CONCENTRATIONS.
*18406 APTIC NO. 37168

**BRENNER E M**
GAS COLLECTION, CLEANING AND CONTROL AT SAKO SUNDSVALL WORKS.
*18005 APTIC NO. 36367

**BRION J**
USE OF FUMIGENS FOR THE STUDY OF VENTILATION. RECYCLING EVALUATION, MEASUREMENT OF TRANSIT TIME.
18128 APTIC NO. 36445

**BROCKHAUS A**
MEASUREMENTS OF CONCENTRATIONS OF PARTICULATE POLLUTANTS IN THE RUHR: TECHNICAL EXPERIENCES AND COMPARISONS WITH RESULTS FROM OTHER COUNTRIES.
18236 APTIC NO. 36441

**BROOKS R R**
TRENDS IN REFUSE-FIRED BOILER DESIGN.
*17919 APTIC NO. 36277

**BROWN D H**
HYBRID BATTERY SYSTEM.
*17920 APTIC NO. 36089

**BROWN J E**
POLLUTED AIR ABATEMENT DEVICE.
*18006 APTIC NO. 36536

**BROWN R L**
INHIBITORY PRODUCTS OF THE ACTION OF PEROXYACETYL NITRATE UPON INDOLE-3-ACETIC ACID.
18458 APTIC NO. 36194

**BUCK M**
RESULTS OF SULPHUR DIOXIDE MEASUREMENTS WITHIN THE AIR MONITORING PROGRAMME OF NORTH RHINE WESTPHALIA.
*18232 APTIC NO. 36380

**BUCK W B**
LEAD AND ORGANIC PESTICIDE POISONINGS IN CATTLE.
*18452 APTIC NO. 36196

**BUICULESCU I**
CONSIDERATIONS ON THE EFFECTS OF ATMOSPHERE IMPURIFICATION UPON THE FLORA AND VEGETATION OF THE COPSA MICA REGION.
18459 APTIC NO. 36803

**BURCH D E**
ABSORPTION AND EMISSION BY SO2 BETWEEN 1050 and 1400/CM (9.5-7.1 MICRON). (FINAL TECHNICAL REPORT).
*18129 APTIC NO. 36185

**BURGAN J G**
POLYNUCLEAR HYDROCARBONS IN TOBACCO AND TOBACCO SMOKE.
18127 APTIC NO. 36373

**BURTON W M**
USE OF LONG-LIVED NATURAL RADIOACTIVITY AS AN ATMOSPHERIC TRACER.
*18282 APTIC NO. 36252

**BUSHMELEV V A**
CHEMISORPTION OF HYDROGEN SULFIDE AND SULFUR DIOXIDE BY A WEAK ALKALINE SOLUTION IN A TURBULENT APPARATUS.
18059 APTIC NO. 36239

**BUXBAUM J**
LEAD IN THE AIR.
*18391 APTIC NO. 36354

**BYCZKOWSKI S**
HISTOLOGICAL INVESTIGATIONS OF THE EFFECT OF NITROGEN OXIDES AND OZONE ON SOME ORGANS OF LABORATORY ANIMALS.
*18392 APTIC NO. 36284

**BYERS R K**
URINARY EXCRETION OF LEAD IN CHILDREN.
*18393 APTIC NO. 36208

C

**CAIRNS C E**
ANALYSIS OF RECOVERY UNIT OPERATION AND CONTROL.
18009 APTIC NO. 36854

**CAMPBELL J A**
CANCER OF SKIN AND INCREASE IN INCIDENCE OF PRIMARY TUMOURS OF LUNG IN MICE EXPOSED TO DUST OBTAINED FROM TARRED ROADS.
*18394 APTIC NO. 36403

**CAPPELLI A**
KINETICS OF SULFUR DIOXIDE OXIDATION WITH MONTECATINI EDISON CATALYST AND MATHEMATICAL MODEL OF AN INDUSTRIAL REACTOR.
18357 APTIC NO. 36219

**CARLON H R**
HEATED CHEMICAL CONVERSION FILTER ASSEMBLY FOR AEROSOL ANALYSIS.
*18130 APTIC NO. 36912

**CARLTON JONES D**
TALL CHIMNEY CONSTRUCTION.
ERROR

**CARMAN P C**
THE NEW CHALLENGE TO CHEMISTRY: POLLUTION.
*18533 APTIC NO. 36091

**CARPENTER K E**
THE LETHAL ACTION OF SOLUBLE METALLIC SALTS ON FISHES.
*18453 APTIC NO. 36265

**CARR W F**
HYDROCYCLONE.
*18008 APTIC NO. 37171

**CARROLL H B JR**
PHOTOCHEMICAL REACTIVITY OF DIESEL EXHAUST. SOME PRELIMINARY TESTS.
17925 APTIC NO. 36053

**CARSON J E**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**CARTWRIGHT J**
PARTICLE SHAPE FACTORS.
*18355 APTIC NO. 36371

**CARTWRIGHT L C**
ORGANOLEPTIC EVALUATION. SENSORY PANEL TESTING CAN HELP PROTECT FOOD PRODUCTS FROM CHANGES OF AROMA AND FLAVOR IMPARTED BY PACKAGING MATERIALS.
*18131 APTIC NO. 36101

**CASTELLINO N**
INTRACELLULAR DISTRIBUTION OF LEAD IN THE LIVER AND KIDNEY OF THE RAT.
*18395 APTIC NO. 36251

**CHAKRABORTY B B**
GAS CHROMATOGRAPHIC ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN SOOT SAMPLES.
*18132 APTIC NO. 36464

**CHAMBERLAIN R E**
ANALYSIS OF RECOVERY UNIT OPERATION AND CONTROL.
*18009 APTIC NO. 36854

**CHAMOT C**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**CHAPOUX E**
FRENCH STUDIES OF POLLUTION BY MOTOR CAR EXHAUST GASES.
*18133 APTIC NO. 36394

**CHEN C J**
ON THE ASCENT OF PILOT-BALLONS IN THE LOWER ATMOSPHERE.
*18283 APTIC NO. 36497

**CHENG R T**
CONTRIBUTION TO THE REACTION KINETICS OF WATER SOLUBLE AEROSOLS AND SO2 IN AIR AT PPM CONCENTRATIONS.
*18284 APTIC NO. 36882

**CHERRY W R**
THE GENERATION OF POLLUTION FREE ELECTRICAL POWER FROM SOLAR ENERGY.
*17921 APTIC NO. 36099

**CHILCOTE D O**
STRAW UTILIZATION RESEARCH.
*17922 APTIC NO. 36348

**CHISOLM J J**
TREATMENT OF LEAD POISONING.
*18396 APTIC NO. 36152

**CHISOLM J J JR**
AMINO-ACIDURIA, HYPOPHOSHATEMIA, AND RICKETS IN LEAD POISONING.
*18398 APTIC NO. 36245
THE EXPOSURE OF CHILDREN TO LEAD.
*18399 APTIC NO. 36266
LEAD POISONING IN CHILDHOOD - COMPREHENSIVE MANAGEMENT AND PREVENTION.
*18397 APTIC NO. 36207

**CHOVIN P**
ATMOSPHERIC POLLUTION IN PARIS BY VEHICLE EXHAUST GASES - MEASUREMENT OF POLLUTION LEVELS AND FIRST SUGGESTED REMEDIES.
*18233 APTIC NO. 36385

**CHOW T J**
THE OCCURRENCE AND SIGNIFICANCE OF LEAD ISOTOPES IN PELAGIC SEDIMENTS.
*18356 APTIC NO. 36103

**CHUFAROV G I**
KINETICS OF THE REACTION BETWEEN SO2 AND H2S.
18379 APTIC NO. 36086

**CLARKE J F**
SOME CLIMATOLOGICAL ASPECTS OF HEAT WAVES IN THE CONTIGUOUS UNITED STATES.
*18400 APTIC NO. 36192

**CLIFTON M**
HEALTH, WEATHER AND THE URBAN SCENE.
*18401 APTIC NO. 36461

**CLINGAN T A JR**
ANALYSIS OF IMPORTANT RECENT ENVIRONMENTAL CASES.
*18500 APTIC NO. 36896

**COHEN A S**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**COLLINA A**
KINETICS OF SULFUR DIOXIDE OXIDATION WITH MONTECATINI EDISON CATALYST AND MATHEMATICAL MODEL OF AN INDUSTRIAL REACTOR.
*18357 APTIC NO. 36219

**COLOSI ESCA D**
CONTRIBUTIONS TO THE APPLICABILITY IN THE FIELD OF THE METHOD WITH PARADIMETHLYPHENYLENDIAMINE MEASURING HYDROGEN SULFIDE IN THE AIR.
*18134 APTIC NO. 36510

**COMEAU G**
FLUORIDE INJURY SYMPTOMS IN EPIPHYTIC LICHENS AND MOSSES.
18461 APTIC NO. 36883

**COMMINS B T**
POLYCYCLIC HYDROCARBONS IN CIGARETTE SMOKE.
*18135 APTIC NO. 36372

**CONLEY L A**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**COOPER R L**
POLYCYCLIC HYDROCARBONS IN CIGARETTE SMOKE.
18135 APTIC NO. 36372
ATMOSPHERIC POLLUTION BY POLYCYCLIC HYDROCARBONS.
*18234 APTIC NO. 36399

**COOPER W C**
BIOLOGIC EFFECTS OF NITROGEN DIOXIDE IN RELATION TO AIR QUALITY STANDARDS.
*18402 APTIC NO. 36362

**CORN M**
CONTRIBUTION TO THE REACTION KINETICS OF WATER SOLUBLE AEROSOLS AND SO2 IN AIR AT PPM CONCENTRATIONS.
18284 APTIC NO. 36882

**CORRIVEAU C**
RATE OF REACTION OF GASEOUS NITROGEN OXIDES WITH WATER.
*18358 APTIC NO. 36077

**COURTNEY R L**
INVESTIGATION OF THE MECHANISM OF EXHAUST VALVE SEAT WEAR IN ENGINES RUN ON UNLEADED GASOLINE.
18474 APTIC NO. 36051

**COUTANT R W**
SO2 PICKUP BY LIMESTONE AND DOLOMITE PARTICLES IN FLUE GAS.
*18010 APTIC NO. 36455

**COWHERD C JR**
ECONOMIC EFFECTS OF AIR POLLUTION ON MATERIALS.
*18480 APTIC NO. 36213

**CRAIG R C**
AN ELECTROSTATIC SEPARATOR.
18081 APTIC NO. 36299

**CRAWFORD R W**
AN EXPERIMENTAL SYSTEM FOR DETERMINING NITROGEN OXIDES IN AIR.
18191 APTIC NO. 36203

**CROFTON E C**
RECENT TRENDS IN MORTALITY FROM LUNG CANCER AND BRONCHITIS IN URBAN AND RURAL AREAS IN SCOTLAND.
*18403 APTIC NO. 36366

**CROKE E J**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
*18501 APTIC NO. 36342

**CROKE K G**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**CROUSE W W**
EFFECT OF UNLEADED FUEL ON LUBRICANT PERFORMANCE.
*17923 APTIC NO. 36080

**CROW J F**
CHEMICAL RISK TO FUTURE GENERATIONS.
*18404 APTIC NO. 36398

**CUCCHETTO M**
KINETICS OF SULFUR DIOXIDE OXIDATION WITH MONTECATINI EDISON CATALYST AND MATHEMATICAL MODEL OF AN INDUSTRIAL REACTOR.
18357 APTIC NO. 36219

**CUDBY E A**
GAS SAMPLE ANALYSIS CELLS.
18213 APTIC NO. 36915

**CURCIO J A**
EVALUATION OF ATMOSPHERIC AEROSOL PARTICLE SIZE DISTRIBUTION FROM SCATTERING MEASUREMENTS IN THE VISIBLE AND INFRARED.
*18285 APTIC NO. 36215

**CUSHMAN M**
URINARY EXCRETION OF LEAD IN CHILDREN.
18393 APTIC NO. 36208

**CZAJKOWSKI G J**
HYDRODESULFURIZATION OF ATMOSPHERIC AND VACUUM GAS OILS.
18108 APTIC NO. 36417

## D

**DAMS R**
CHEMISTRY AND DETERMINATION OF AIR POLLUTANTS.
*17924 APTIC NO. 36045

**DAVIDSON H**
PINE MORTALITY ALONG MICHIGAN HIGHWAYS.
*18454 APTIC NO. 36140

**DAVIES C N**
THE MECHANICS OF AEROSOLS IN THE THEORY OF SAMPLING.
*18136 APTIC NO. 36201

**DEBRUN G**
THE FIGHT AGAINST AIR POLLUTION FROM E.D.F. POWER STATIONS.
*18011 APTIC NO. 36427

**DECKER F W**
PROBABILITIES OF COOLING SYSTEM FOGGING.
*18286 APTIC NO. 36352

**DEJONGHE P**
DRY PURIFICATION OF INCINERATOR OFF-GASES.
*18012 APTIC NO. 36174

**DELLER R W**
EFFECTS OF MIXTURE DISTRIBUTION ON EXHAUST EMISSIONS AS INDICATED BY ENGINE DATA AND THE HYDRAULIC ANALOGY.
17946 APTIC NO. 36116

**DELPEYROUX J**
FRENCH STUDIES OF POLLUTION BY MOTOR CAR EXHAUST GASES.
18133 APTIC NO. 36394

**DENTE**
KINETICS OF SULFUR DIOXIDE OXIDATION WITH MONTECATINI EDISON CATALYST AND MATHEMATICAL MODEL OF AN INDUSTRIAL REACTOR.
18357 APTIC NO. 36219

**DERJAGUIN B V**
THEORY OF THERMOPHORESIS OF VOLATILE AEROSOL PARTICLES AND DROPLETS OF SOLUTIONS.
18381 APTIC NO. 36914

**DERVIZ G**
THE PROBLEM OF THE FATE OF MERCURY FUMES AND MERCURIAL COMPOUNDS IN THE ORGANISM.
18417 APTIC NO. 36227

**DHARMARAJAN V**
MICRODETERMINATION OF CADMIUM AIRBORNE PARTICULATES BY MEANS OF THE RING-OVEN TECHNIQUE.
*18137 APTIC NO. 36034

**DIAMANT R M E**
THE PREVENTION OF POLLUTION. PART X – AIR POLLUTION.
*18013 APTIC NO. 37174

**DIAMANT W**
OPTICAL METHODS IN AIR POLLUTION RESEARCH.
*18138 APTIC NO. 36440

**DICKENS B H**
TAX-FREE FINANCING OF POLLUTION CONTROL FACILITIES.
*18502 APTIC NO. 36895

**DICKERSON W D**
SENSITIVITY ANALYSIS OF SELECTED AIR QUALITY IMPLEMENTATION PLANNING PROGRAM INPUT PARAMETERS.
*18503 APTIC NO. 36090

**DIENEMANN P F**
AIR POLLUTION IMPACTS.
*18014 APTIC NO. 36344

**DIMITRIADES B**
PHOTOCHEMICAL REACTIVITY OF DIESEL EXHAUST. SOME PRELIMINARY TESTS.
*17925 APTIC NO. 36053

**DJURIC D**
ENVIRONMENTAL CONTAMINATION BY LEAD FROM A MINE AND SMELTER.
*18405 APTIC NO. 36283

**DOMRACHEV G A**
CATALYTIC REDUCTION OF TERTRAPHENYL LEAD WITH BIS-ALLYL PALLADIUM CHLORIDE.
*18359 APTIC NO. 36524

**DORAN J J**
ELECTRIC POWER - IMPACT ON THE ENVIRONMENT.
*18504 APTIC NO. 36406

**DOROFEEV V V**
METHOD AND APPARATUS FOR THE QUANTITATIVE MEASUREMENT OF CERTAIN COMPONENTS OF A GAS MIXTURE.
18125 APTIC NO. 36801

**DRINKER P**
HANDBOOK ON AIR CLEANING PARTICULATE REMOVAL.
18020 APTIC NO. 36184

**DUCKERING D W**
THE ILLINOIS TRACER EXPERIMENT - 1970. A SUMMARY REPORT OF ACTIVITIES CONDUCTED BY ATMOSPHERICS INCORPORATED.
18298 APTIC NO. 36210

**DUCKERING G E**
THE CAUSE OF LEAD POISONING IN THE TINNING OF METALS.
*18406 APTIC NO. 36093

**DUFFY T L**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**DUMON R**
TREATMENT OF LIQUID EFFLUANTS IN A NEW ELF-HEURTY TYPE INCINERATOR.
*18015 APTIC NO. 36478

**DUNNING J A**
RESPONSE OF PINTO BEAN AND TOBACCO TO OZONE AS CONDITIONED BY LIGHT INTENSITY AND/OR HUMIDITY.
*18455 APTIC NO. 36057

**DURAND G**
CONFERENCE OF PROFESSOR ROUSSEL AT LILLE OF MARCH 30, 1968.
*18407 APTIC NO. 36409

**DYMENT J**
THE PENETRATION OF FIBROUS MEDIA BY AEROSOLS AS A FUNCTION OF PARTICLE SIZE.
*18016 APTIC NO. 36173

E

**EBERLEIN W R**
AMINO-ACIDURIA, HYPOPHOSHATEMIA, AND RICKETS IN LEAD POISONING.
18398 APTIC NO. 36245

**EBISAWA E**
AIR POLLUTION OF HITACHI DISTRICT (REPORT 2).
*18287 APTIC NO. 36810

**EFIMOVA T A**
POTENTIOMETRIC DETERMINATIONS OF THE GROUP COMPOSITION OF SULFUR COMPOUNDS PRESENT IN STRAIGHT-RUN GASOLINE FRACTIONS.
17966 APTIC NO. 36533

**EGUCHI T**
INSTRUMENTATION OF NOx ANALYZER BY CHEMILUMINESCENCE METHOD.
*18139 APTIC NO. 36856
INSTRUMENTATION OF VEHICLE EXHAUST NOx ANALYZER BY SALTZMAN METHOD.
*18140 APTIC NO. 36861

**ELSHOUT A I**
THE EMISSION OF NITROGEN OXIDES.
17940 APTIC NO. 36044

**ELSHOUT A J**
INVESTIGATION INTO CORROSION IN THE ELECTRO-FILTERS OF GARBAGE INCINERATION PLANT.
18475 APTIC NO. 36828

**ENDO A**
MEASURING METHOD FOR OXIDANT BY ETHYLENE.
*18141 APTIC NO. 36834

**ENDO K**
STUDIES ON THE ERRORS OF SULFUR DIOXIDE DETERMINATION IN THE ATMOSPHERE BY WEST-GAEKE METHOD.
18206 APTIC NO. 36097

**ENDO M**
AIR POLLUTION CAUSED BY EXHAUST GAS OF AUTOMOBILES IN SHIZUOKA PREFECTURE.
18270 APTIC NO. 36909

**ENDO R**
ON THE ENVIRONMENTAL CONDITIONS OF THE SURVEY POINT HEAVILY CONTAMINATED BY THE AUTOMOTIVE EXHAUST GAS.
*18235 APTIC NO. 37165

**ENDO Y**
TRACE METALS IN SUSPENDED PARTICULATES.
18252 APTIC NO. 36486

**ENDSLEY L E JR**
EFFECT OF DIESEL FUEL ON EXHAUST SMOKE AND ODOR.
17977 APTIC NO. 36060

**EPSTEIN S S**
CHEMICAL MUTAGENS IN THE HUMAN ENVIRONMENT.
*18408 APTIC NO. 36327

**ERIKSEN W**
LOCAL CLIMATIC CONSEQUENCES OF URBAN DEVELOPMENT.
*18288 APTIC NO. 37201

**ESSENHIGH R H**
THE PROBLEM OF SMOKE FORMATION AND CONTROL.
17918 APTIC NO. 36070

**EYRAUD C**
A NEW DUST COLLECTOR USING ELECTROSTATICALLY SPRAYED WATER.
*18017 APTIC NO. 36395

## F

**FAIRCHILD E J II**
PROTECTION BY SULFUR COMPOUNDS AGAINST THE AIR POLLUTANTS OZONE AND NITROGEN DIOXIDE.
*18409 APTIC NO. 36224

**FARRELL D M**
THE DETERMINATION OF QUARTZ IN DUST BY INFRARED SPECTROSCOPY.
18142 APTIC NO. 36285

**FERRAIOLO G**
INSTALLATION FOR THE WASHING OF INDUSTRIAL GASES. NOTE I INFLUENCE OF THE TYPE OF PACKING SURFACE ON THE FLOW DYNAMICS OF THE ABSORBER.
*18018 APTIC NO. 36526

**FERRIS B G**
CHRONIC NONSPECIFIC RESPIRATORY DISEASE. BERLIN, N.H., 1961-1967 - A PROSPECTIVE STUDY.
*18410 APTIC NO. 36217

**FERRIS G K**
AIR POLLUTION CONTROL SYSTEMS.
*18019 APTIC NO. 36031

**FETH J H**
CHEMICAL CHARACTERISTICS OF BULK PRECIPITATION IN THE MOJAVE DESERT REGION, CALIFORNIA.
*18289 APTIC NO. 36458

**FETNER R H**
CHROMOSOME BREAKAGE IN VICIA FABA BY OZONE.
*18456 APTIC NO. 36326

**FINDLAY B F**
AN URBAN-INDUCED MESO-CIRCULATION.
*18290 APTIC NO. 36397

**FIRGER V V**
EFFECT OF MINERAL NUTRITION ON THE METABOLISM OF CARBON-14 COMPOUNDS AND ON GAS RESISTANCE OF FORAGE PLANTS.
*18457 APTIC NO. 36164
METABOLISM OF CARBON-14 COMPOUNDS IN FORAGE GRASSES AND THE EFFECT OF SULFUR DIOXIDE ON IT.
18466 APTIC NO. 36165

**FIRKET J**
ABOUT THE CAUSES OF THE ACCIDENTS WHICH OCCURRED IN THE MEUSE VALLEY DURING THE FOG OF DECEMBER 1930.
*18291 APTIC NO. 36410

**FIRST M W**
HANDBOOK ON AIR CLEANING PARTICULATE REMOVAL.
18020 APTIC NO. 36184

**FISHBURN C W**
METAL FUME FEVER. A REPORT OF A CASE.
*18411 APTIC NO. 36241

**FISHER V**
THE EMPHYSEMA PROFILE IN TWO MIDWESTERN CITIES IN NORTH AMERICA.
18425 APTIC NO. 36400

**FONTAN J**
MEASUREMENT OF VERTICAL TRANSPORT OF NATURAL RADIOACTIVITY BY TURBULENT DIFFUSION.
*18292 APTIC NO. 36096

**FORBES G W JR**
SOOT EMISSION FROM RESIDENTIAL DISTILLATE OIL BURNERS IN MARYLAND.
18257 APTIC NO. 36193

**FRANK N R**
A COMPARISON OF THE ACUTE EFFECTS OF SO2 ADMINISTERED ALONE OR IN COMBINATION WITH NACL PARTICLES ON THE RESPIRATORY MECHANICS OF HEALTHY ADULTS.
*18412 APTIC NO. 36363
AN OZONE JOURNAL.
*18413 APTIC NO. 36370

**FRANKS R G E**
MATH MODELING OF AN EXHAUST REACTOR.
18003 APTIC NO. 36104

**FRASER A M**
MERCURY-LADEN AIR: THE TOXIC CONCENTRATION, THE PROPORTION ABSORBED, AND THE URINARY EXCRETION.
*18414 APTIC NO. 36228

**FRENZEL J**
MEASURES AIMED AT KEEPING THE AIR CLEAN WITH SPECIAL REGARD TO PRESENT LEGISLATION. - MODEL CASE OF LINZ.
*18505 APTIC NO. 36529

**FRICKE L B**
A WIND TUNNEL INVESTIGATION OF JETS EXHAUSTING INTO A CROSSFLOW. VOLUME IV. ADDITIONAL DATA FOR THE THREE-JET CONFIGURATION.
*18360 APTIC NO. 36137

**FRIEDLANDER S K**
HANDBOOK ON AIR CLEANING PARTICULATE REMOVAL.
*18020 APTIC NO. 36184

**FRIEDRICHS K H**
MEASUREMENTS OF CONCENTRATIONS OF PARTICULATE POLLUTANTS IN THE RUHR: TECHNICAL EXPERIENCES AND COMPARISONS WITH RESULTS FROM OTHER COUNTRIES.
*18236 APTIC NO. 36441

**FRIEND G**
AMMONIA INJECTION FOR NEUTRALISING BOILER FUMES.
*18021 APTIC NO. 36507

**FROHLIGER J O**
CONTRIBUTION TO THE REACTION KINETICS OF WATER SOLUBLE AEROSOLS AND SO2 IN AIR AT PPM CONCENTRATIONS.
18284 APTIC NO. 36882

**FRONTCZAK A**
THE EFFECT OF THE KIND OF RESPIRATION AND OF THE AIR IRRITATING THE RESPIRATORY TRACT ON THE VITAL CAPACITY OF THE LUNGS.
*18415 APTIC NO. 36259

**FUCHS N A**
FORMATION OF CONDENSATION AEROSOLS UNDER RAPIDLY CHANGING ENVIRONMENTAL CONDITIONS. NON-COAGULATED, HIGH-DISPERSED AEROSOLS.
18341 APTIC NO. 36039

**FUJII I**
ATMOSPHERIC CONCENTRATION OF SULFUR OXIDES IN OSAKA PREFECTURE.
*18237 APTIC NO. 36842

**FUJII J**
TRACE METALS IN SUSPENDED PARTICULATES (VII).
18242 APTIC NO. 36499

**FUJII T**
CATALYTIC COMBUSTION OF HYDROCARBON VAPORS.
18049 APTIC NO. 36472
ON THE ATMOSPHERIC CONCENTRATION OF POLYCYCLIC HYDROCARBONS IN URBAN AREA.
18255 APTIC NO. 36844

**FUKUDA T**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843
THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**FUKUOKA S**
AIR POLLUTION FORECASTING PROGRAM.
18304 APTIC NO. 36308
SOME STUDIES ABOUT FORECASTING OF PHOTOCHEMICAL SMOG.
18316 APTIC NO. 37192

**FUKUSHIMA Y**
EVALUATION OF ODOR POLLUTION.
18167 APTIC NO. 36468

**FUQUAY J J**
USE OF METEOROLOGICAL MEASUREMENTS FOR PREDICTING DISPERSION FROM RELEASES NEAR GROUND LEVEL.
*18293 APTIC NO. 36176

**FURUKAWA Y**
URBAN AIR POLLUTION BY LEAD - YOKOHAMA AND VICINITY.
18246 APTIC NO. 36820

**FURUZONO S**
STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (II) - BASED ON METEOROLOGICAL FACTORS.
18324 APTIC NO. 36494

**FUTAKI N**
OBSERVATION ON THE BASIC INVESTIGATION METHOD FOR BAD ODOR

FROM THE STANDPOINT OF ON-SITE TESTS. (A SEQUEL).
18150 APTIC NO. 36894

**FUTAKI S**
AN EXAMPLE OF INVESTIGATION METHODS FOR ODOR POLLUTION.
18244 APTIC NO. 36910

G

**GABBERT W L**
EQUIPMENT FOR THE COLLECTION OF FLY ASH, DUST, SOOT, AND SMOKE FROM THE FLUE-FED INCINERATOR.
*18022 APTIC NO. 36369

**GAGGERO M**
INSTALLATION FOR THE WASHING OF INDUSTRIAL GASES. NOTE I INFLUENCE OF THE TYPE OF PACKING SURFACE ON THE FLOW DYNAMICS OF THE ABSORBER.
18018 APTIC NO. 36526

**GALLOPOULOS N E**
PROJECTED LUBRICANT REQUIREMENTS OF ENGINES OPERATING WITH LEAD-FREE GASOLINE.
*18023 APTIC NO. 36145

**GALOIAN V S**
THEORY OF THERMOPHORESIS OF VOLATILE AEROSOL PARTICLES AND DROPLETS OF SOLUTIONS.
18381 APTIC NO. 36914

**GAMO I**
INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**GANGOLLI S D**
ANALYTICAL CHEMISTRY IN TOXICITY TESTING.
*18416 APTIC NO. 36338

**GASKILL J R**
SMOKE DEVELOPMENT IN POLYMERS DURING PYROLYSIS OR COMBUSTION.
*17927 APTIC NO. 36364

**GATZ D F**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**GEDEONOV L I**
USE OF COSMOGENIC RADIOISOTOPE MIGRATION PATTERNS IN THE STUDY OF THE PROPAGATION OF RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE. 1967 (?).
*18294 APTIC NO. 36062

**GELMAN J**
THE PROBLEM OF THE FATE OF MERCURY FUMES AND MERCURIAL COMPOUNDS IN THE ORGANISM.
*18417 APTIC NO. 36227

**GEORGII H**
THE CONCENTRATION OF CARBON MONOXIDE MEASURED AT DIFFERENT ALTITUDES SIMULTANEOUSLY IN CITY STREETS.
*18238 APTIC NO. 36388

**GILBERT J A S**
POLYCYCLIC HYDROCARBONS IN TOBACCO SMOKE: PIPE SMOKING EXPERIMENTS.
*17928 APTIC NO. 36359

**GILES W**
VALVE PROBLEMS WITH LEAD-FREE GASOLINE.
*18024 APTIC NO. 36144

**GILLHAM E W F**
SULPHUR DIOXIDE CONCENTRATIONS MEASURED AROUND A MODERN POWER STATION.
*18239 APTIC NO. 36384

**GILLIESON A H**
THE DETERMINATION OF QUARTZ IN DUST BY INFRARED SPECTROSCOPY.
*18142 APTIC NO. 36285

**GOCKE T M**
WHAT IS THE ROLE OF AIR POLLUTION AS A CAUSE OF DISEASE? Am. J. Public Health, 54(1):71-78, Jan. 1964. 17 refs.
*18418 APTIC NO. 36155
INVESTIGATION OF THE MECHANISM OF EXHAUST VALVE SEAT WEAR IN ENGINES RUN ON UNLEADED GASOLINE.
*18474 APTIC NO. 36051

**GODWIN T**
THE SIMULTANEOUS EXTRACTION OF IRON, MANGANESE, COPPER, COBALT, NICKEL, CHROMIUM, LEAD, AND ZINC FROM NATURAL WATER FOR DETERMINATION BY ATOMIC ABSORPTION SPECTROSCOPY.
18371 APTIC NO. 36067

**GOLDBERG E D**
PESTICIDES: TRANSLALANTIC MOVEMENTS IN THE NORTHEAST TRADES.
18330 APTIC NO. 36351

**GOLDMAN M D**
CHRONIC NONSPECIFIC RESPIRATORY DISEASE. BERLIN, N.H., 1961-1967 - A PROSPECTIVE STUDY.
18410 APTIC NO. 36217

**GORE A T**
ATMOSPHERIC POLLUTION AND MORTALITY IN THE COUNTY OF LONDON.
*18419 APTIC NO. 36361

**GOVERS T R**
TRANSLATIONAL SPECTROSCOPY OF THE UNIMOLECULAR DISSOCIATION NO+ YIELDS O+ PLUS N.
*18361 APTIC NO. 36036

**GRAAF H D**
GROUND FOG.
*18295 APTIC NO. 36825

**GRANDJEAN J**
AIR POLLUTION BY SMOKE AND SO2.
18231 APTIC NO. 36444
AIR POLLUTION BY SMOKE AND SO2.
18230 APTIC NO. 36234

**GRANICK S**
PORPHYRIN BIOSYNTHESIS IN ERYTHROCYTES. III. UROPORPHYRINOGEN AND ITS DECARBOXYLASE.
18434 APTIC NO. 36190

**GRANITZER H**
THE COUPLING OF HEAT SUPPLY WITH POWER SUPPLY IN CITIES.
*18025 APTIC NO. 36917

**GRAOVAC LEPOSAVIC L**
ENVIRONMENTAL CONTAMINATION BY LEAD FROM A MINE AND SMELTER.
18405 APTIC NO. 36283

**GRAVES W M JR**
ASBESTOS AS AN URBAN AIR CONTAMINANT.
18446 APTIC NO. 36360

**GRIFFIN J J**
PESTICIDES: TRANSLALANTIC MOVEMENTS IN THE NORTHEAST TRADES.
18330 APTIC NO. 36351

**GRIMM C D**
HYDRODESULFURIZATION CATALYST SUPPORT MATERIALS.
*18026 APTIC NO. 36189

**GROENENBOOM J**
SMOKE FROM INCINERATORS.
18004 APTIC NO. 36063

**GROSE E S**
AIRBORNE FUNGUS SPORES IN BOGOTA, COLOMBIA: A FIVE YEAR STUDY.
*18240 APTIC NO. 36229

**GROU E**
CONSIDERATIONS ON THE EFFECTS OF ATMOSPHERE IMPURIFICATION UPON THE FLORA AND VEGETATION OF THE COPSA MICA REGION.
18459 APTIC NO. 36803

**GRUB W**
GAS PRODUCTION FROM BEEF CATTLE WASTES.
17950 APTIC NO. 36404

**GRUEMM H**
ENERGY GENERTION AND THE ENVIRONMENT.
*17929 APTIC NO. 36481

**GRUNEWALD G W**
A PROCESS FOR REMOVING HYDROGEN SULPHIDE AND CARBON DIOXIDE FUEL GASES AND SYNTHESIS GASES CONTAINING THE SAME.
*18027 APTIC NO. 36220

**GRYVNAK D A**
ABSORPTION AND EMISSION BY SO2 BETWEEN 1050 and 1400/CM (9.5-7.1 MICRON). (FINAL TECHNICAL REPORT).
18129 APTIC NO. 36185

H

**HAHNEMANN H W**
CLEAN AIR WITH HOT WATER EJECTORS.
*18028 APTIC NO. 37189

**HALL M A**
INHIBITORY PRODUCTS OF THE ACTION OF PEROXYACETYL NITRATE UPON INDOLE-3-ACETIC ACID.
*18458 APTIC NO. 36194

**HAMADA T**
FUNDAMENTAL RESEARCH ON DEODORIZATION BY OXIDATION IN FLUIDIZED BED.
18065 APTIC NO. 37162

**HAMAMURA N**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843
ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
18303 APTIC NO. 37198
THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**HANAN J J**
SECOND AIR ANALYSES IN THE DENVER REGION.
*18241 APTIC NO. 36054

**HANEDA H**
AUTOMATIC MEASURING APPARATUS OF SO3 MIST IN AIR.
18180 APTIC NO. 36905

**HANNA S R**
METEOROLOGICAL EFFECTS OF COOLING TOWER PLUMES.
*18296 APTIC NO. 36058
SUMMARY OF MEETING ON MESOSCALE ATMOSPHERIC MODELLING (HELD JUNE 14-16, 1971 AT WATTS BAR DAM, TENNESSEE).
*18297 APTIC NO. 36150

**HARDEN C S**
THREE-DIMENSIONAL QUADRUPOLAR MASS ANALYZER. I. GENERAL DESCRIPTION.
*18143 APTIC NO. 36119

**HARDING C I**
AIR POLLUTION PROBLEMS ASSOCIATION WITH KRAFT PULPING.
17930 APTIC NO. 36392

**HARINGTON J S**
HEMOLYSIS BY ASBESTOS.
*18420 APTIC NO. 36276

**HARRIS R J C**
CANCER AND THE ENVIRONMENT.
*18421 APTIC NO. 36141

**HARRISON H C**
AMINO-ACIDURIA, HYPOPHOSHATEMIA, AND RICKETS IN LEAD POISONING.
18398 APTIC NO. 36245

**HARRISON H E**
AMINO-ACIDURIA, HYPOPHOSHATEMIA, AND RICKETS IN LEAD POISONING.
18398 APTIC NO. 36245
THE EXPOSURE OF CHILDREN TO LEAD.
18399 APTIC NO. 36266

**HARVEY R D**
PETROGRAPHIC AND MINERALOGICAL CHARACTERISTICS OF CARBONATE ROCKS RELATED TO SORPTION OF SULFUR OXIDES IN FLUE GASES.
*18029 APTIC NO. 36339

**HASEGAWA T**
TRACE METALS IN SUSPENDED PARTICULATES (VII).
*18242 APTIC NO. 36499

**HASENCLEVER D**
THE USE OF RADIOACTIVE INDICATOR SUBSTANCES FOR SOLVING DUST PROBLEMS.
*18030 APTIC NO. 36413

**HASHIMOTO K**
TREATMENT OF HYDROGEN SULFIDE GAS AT TAGONOURA HARBOR.
18091 APTIC NO. 37200
STUDIES ON THE INDUSTRIAL LEAD POISONING. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN HUMAN BEING THROUGH THE RESPIRATORY TRACT.
18423 APTIC NO. 36129

**HASHIMOTO N**
URBAN AIR POLLUTION BY LEAD - YOKOHAMA AND VICINITY.
18246 APTIC NO. 36820

**HATTORI T**
STUDY OF THE INFLUENCE OF HYDROGEN SULFIDE (I). A SIMPLE METHOD FOR THE HYDROGEN SULFIDE PAPER BADGE.
ERROR

**HAYAKAWA M**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843
OBSERVATION FROM A TEN YEAR STUDY OF SULFUR DIOXIDE IN NAGOYA BY PB2 METHOD.
*18243 APTIC NO. 37199
THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**HAYASHI H**
STUDIES ON PERFORMANCE TEST METHOD FOR EXHAUST GAS TREATMENT CATALYST REACTOR (REPORT 3). EXAMINATION OF CONDITIONS FOR CATALYST ACTIVITY TEST.
*18031 APTIC NO. 36301

**HAYASHI J**
INVESTIGATION OF AIR POLLUTION IN SOUTHERN AREA OF NAGOYA.
18273 APTIC NO. 37186

**HAYASHI Y**
HEAT CAPACITY CHANGES PREDICT NITROGEN OXIDES REDUCTION BY EXHAUST GAS RECIRCULATION.
18075 APTIC NO. 36158

**HAYES C T**
CUT INDUSTRIAL POLLUTION BY ELIMINATING GASEOUS WASTE.
*18032 APTIC NO. 36516

**HAYES J V**
DISPERSION AND DEPOSITION OF CORN POLLEN FROM EXPERIMENTAL SOURCES.
18329 APTIC NO. 36111

**HAYNES C D**
ATMOSPHERIC POLLUTION FROM PETROL ENGINES. CONTROL OF OXIDES OF NITROGEN BY EXHAUST RECIRCULATION.
*18033 APTIC NO. 36138

**HECK W W**
RESPONSE OF PINTO BEAN AND TOBACCO TO OZONE AS CONDITIONED BY LIGHT INTENSITY AND/OR HUMIDITY.
18455 APTIC NO. 36057

**HEINDRYCKX R**
CHEMISTRY AND DETERMINATION OF AIR POLLUTANTS.
17924 APTIC NO. 36045

**HEINSOHN R J**
FLAMES, IONS, AND ELECTRIC FIELDS.
*18034 APTIC NO. 36075

**HEMMINGSON M E**
CHIMNEY ASPIRATOR.
*18035 APTIC NO. 36869

**HENDERSON J S**
AIR POLLUTION CONTROL. PART ONE: LAWS AND THEIR IMPACT.
*18506 APTIC NO. 36368

**HENDERSON T J**
THE ILLINOIS TRACER EXPERIMENT - 1970. A SUMMARY REPORT OF ACTIVITIES CONDUCTED BY ATMOSPHERICS INCORPORATED.
*18298 APTIC NO. 36210

**HENDRICKSON E R**
AIR POLLUTION PROBLEMS ASSOCIATION WITH KRAFT PULPING.
*17930 APTIC NO. 36392

**HENEIN N A**
A MATHEMATICAL MODEL FOR THE MASS TRANSFER AND COMBUSTIBLE MIXTURE FORMATION AROUND FUEL DROPLETS.
*18362 APTIC NO. 36100

**HENRY C**
A NEW DUST COLLECTOR USING ELECTROSTATICALLY SPRAYED WATER.
18017 APTIC NO. 36395

**HENSON E B**
CHEMICAL CHARACTERISTICS OF PRECIPITATION IN CHAMPLAIN VALLEY.
*18299 APTIC NO. 36345

**HERBERT G F**
POWER REQUIREMENTS OF ELECTRIC VEHICLES.
*17931 APTIC NO. 36128

**HERPERTZ E**
DUST FALL MEASUREMENTS IN THE STATE OF NORDRHEIN-WESTFALEN

FROM OCTOBER 1, 1967 TILL SEPTEMBER 30 1968.
18260 APTIC NO. 36408

**HERVERT G L**
APPARATUS FOR REDUCING EVAPORATIVE LOSSES FROM AN ENGINE CARBURETOR.
*18036 APTIC NO. 36356

**HIBI H**
AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.
18499 APTIC NO. 36306

**HIETBRINK E H**
ELECTRIC STORAGE BATTERIES FOR VEHICLE PROPULSION.
*17932 APTIC NO. 36451

**HIGGINS I T T**
CHRONIC NONSPECIFIC RESPIRATORY DISEASE. BERLIN, N.H., 1961-1967 - A PROSPECTIVE STUDY.
18410 APTIC NO. 36217

**HIGGINS M W**
CHRONIC NONSPECIFIC RESPIRATORY DISEASE. BERLIN, N.H., 1961-1967 - A PROSPECTIVE STUDY.
18410 APTIC NO. 36217

**HIMI K**
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS NO.2 COLLECTION EFFICIENCY OF THIMBLE FILTER.
18148 APTIC NO. 36840
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS. NO. 1 STUDY ON THE IMPURITY METAL IN THIMBLE FILTER.
18184 APTIC NO. 36841

**HINDS W C**
OPTICAL PROPERTIES OF SODIUM AEROSOLS.
18373 APTIC NO. 36537

**HIRAI Y**
AFTERBURNER TYPE EXHAUST PURIFICATION APPARATUS.
*18037 APTIC NO. 36880

**HIRAMATSU A**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

**HIRAO S**
ATMOSPHERIC CONCENTRATION OF SULFUR OXIDES IN OSAKA PREFECTURE.
18237 APTIC NO. 36842

**HIRAOKA M**
AIR POLLUTION OF URBAN SCALE AND METEOROLOGICAL FACTOR.
18302 APTIC NO. 36492

**HIROBE H**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**HIRONO T**
ON HEAVY METALS IN SUSPENDED PARTICULATE AND LOCAL CHARACTERISTICS IN TOKYO.
18251 APTIC NO. 37191

**HIRT M S**
AN URBAN-INDUCED MESO-CIRCULATION.
18290 APTIC NO. 36397

**HISAKA T**
DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (II) SOME QUESTIONS FOR DETERMINATION OF HYDROCARBONS BY THE HYDROCARBON ANALYZER.
18205 APTIC NO. 36836

**HISHIDA K**
CONTROL OF VEHICLE EXHAUST GAS IN THE CASE OF MUNICIPAL GOVERNMENT.
18520 APTIC NO. 36506
FORECAST OF SULFUR OXIDES INTENSITY IN TOKYO.
18344 APTIC NO. 36811
CONTROL OF SULFUR OXIDES IN TOKYO.
18523 APTIC NO. 37163
CONTROL OF THE VAPORIZED HYDROCARBON EMISSION.
18110 APTIC NO. 37197
STUDIES OF VEHICLE EXHAUST INTENSITY.
17935 APTIC NO. 37204

**HOCHGESAND G**
A PROCESS FOR REMOVING HYDROGEN SULPHIDE AND CARBON DIOXIDE FUEL GASES AND SYNTHESIS GASES CONTAINING THE SAME.
18027 APTIC NO. 36220

**HODGESON J A**
A STABLE OZONE SOURCE APPLICABLE AS A SECONDARY STANDARD FOR CALIBRATION OF ATMOSPHERIC MONITORS.
*18363 APTIC NO. 36107

**HOEGL A**
MEASURING TECHNIQUES FOR THE DETERMINATION OF THE CONCENTRATION AND MOBILITY OF ATMOSPHERIC IONS.
*18144 APTIC NO. 36055

**HOFFMANN D**
SHORT-TERM DETERMINATION OF CARCINOGENIC AROMATIC HYDROCARBONS.
*18145 APTIC NO. 36358

**HOLL R E**
CONTROL OF ATMOSPHERIC POLLUTION ON EXISTING AND FUTURE SITES OF E.D.F. POWER STATIONS.
*18038 APTIC NO. 36431

**HOLLAND J**
ELECTRIC SHUTDOWN INSTRUMENT SYSTEMS FOR GAS ENGINE OPERATED Equipment.
*18039 APTIC NO. 36350

**HOLM JENSEN I**
MERCURY VAPOUR ABSORBING PAINT.
*18040 APTIC NO. 36324

**HOLSCHER H**
FIFTY YEARS OLDS SHOULD TAKE CARE OF THEIR LEGS.
*18422 APTIC NO. 36540

**HOLZWORTH G C**
VERTICAL TEMPERATURE STRUCTURE DURING THE THANKSGIVING WEEK 1966 AIR POLLUTION EPISODE IN NEW YORK CITY.
*18300 APTIC NO. 36347

**HOMMA K**
THE GENERATORS AND GENERATING METHODS OF THE STANDARD AEROSOLS.
*18364 APTIC NO. 36294
MICRODETERMINATION OF SULPHURIC ACID MIST BY THE THIN METAL FILM METHOD.
*18146 APTIC NO. 36858
MICRODETERMINATION OF ACID MIST BY THE PH FILTER METHOD.
*18147 APTIC NO. 37159

**HONDA T**
THE ESTIMATION OF AUTOMOBILE EXHAUST EMISSIONS IN OSAKA.
*17933 APTIC NO. 36290

**HONMA K**
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS NO.2 COLLECTION EFFICIENCY OF THIMBLE FILTER.
*18148 APTIC NO. 36840
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS. NO. 1 STUDY ON THE IMPURITY METAL IN THIMBLE FILTER.
18184 APTIC NO. 36841

**HORI M**
URBAN AIR POLLUTION BY LEAD - YOKOHAMA AND VICINITY.
18246 APTIC NO. 36820

**HORIUCHI K**
STUDIES ON THE INDUSTRIAL LEAD POISONING. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN HUMAN BEING THROUGH THE RESPIRATORY TRACT.
*18423 APTIC NO. 36129

**HORIUCHI N**
PHOTOCHEMICAL REACTION BETWEEN SO2 AND ORGANIC COMPOUND (III).
*18301 APTIC NO. 36483

**HORIUCHI S**
GAS TURBINE COMBUSTORS.
17972 APTIC NO. 36268

**HORN J**
FUME ABATER CONVERTS WASTE TO USEFUL ENERGY.
*18041 APTIC NO. 36280

**HORN K**
THE AIR HYGIENE PROBLEM IN THE GERMAN DEMOCRATIC REPUBLIC.
*17934 APTIC NO. 36381

**HOSAKA N**
ON THE MEASUREMENT OF OZONE CONCENTRATION IN THE AIR.
*18149 APTIC NO. 36833

**HOSHIKA Y**
OBSERVATION ON THE BASIC INVESTIGATION METHOD FOR BAD ODOR FROM THE STANDPOINT OF ON-SITE TESTS. (A SEQUEL).
*18150 APTIC NO. 36894
AN EXAMPLE OF INVESTIGATION METHODS FOR ODOR POLLUTION.
*18244 APTIC NO. 36910

**HOUSER E A**
ANALYSIS OF CATALYTIC CRACKER REGENERATOR FLUE GAS.
*18151 APTIC NO. 36226

**HOWARD E B**
STUDIES OF INHALED RADON DAUGHTERS, URANIUM ORE DUST, DIESEL EXHAUST, AND CIGARETTE SMOKE IN DOGS AND HAMSTERS.
18443 APTIC NO. 36454

**HU J N**
COMPOSITION, SIZE AND CONTROL OF AUTOMOTIVE EXHAUST PARTICLATES.
17975 APTIC NO. 37176

**HUBER E W**
MEASURING THE TRAPPING EFFICIENCY OF INTERNAL COMBUSTION ENGINES THROUGH CONTINUOUS EXHAUST GAS ANALYSIS.
*18152 APTIC NO. 36110

**HUENIGEN E**
THE REDUCTION OF CARCINOGENIC CONTAMINANTS IN EXHAUST GASES OF PETROL ENGINES THROUGH FUEL ADDITIVES AND CHOICE OF LUBRICANTS.
*18042 APTIC NO. 36437
AN EFFICIENT METHOD AND TYPE OF DEVICE FOR MEASURING, AND A PROPOSAL FOR INTERNATIONALLY ACCEPTABLE LIMITS OF DIESEL SMOKE.
*18153 APTIC NO. 36438

**HUGGETT R J**
PESTICIDES: TRANSLALANTIC MOVEMENTS IN THE NORTHEAST TRADES.
18330 APTIC NO. 36351

**HULL W L**
EFFECTS OF MIXTURE DISTRIBUTION ON EXHAUST EMISSIONS AS INDICATED BY ENGINE DATA AND THE HYDRAULIC ANALOGY.
17946 APTIC NO. 36116

**HUNYADY I**
PROCESS FOR THE DESULFURIZATION OF INDUSTRIAL GASES IN CLOSED CYCLE WITH SIMULTANEOUS EXTRACTION OF PURE SULFUR.
*18043 APTIC NO. 36170

**HURT R J**
EFFECTS OF MIXTURE DISTRIBUTION ON EXHAUST EMISSIONS AS INDICATED BY ENGINE DATA AND THE HYDRAULIC ANALOGY.
17946 APTIC NO. 36116

**HURTER A**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**HUSSEY R**
RECOMMENDED INSTRUMENTATION OF SMALL BOILERS.
*18154 APTIC NO. 36862

**HYATT R E**
EVALUATION OF LUNG MECHANICS IN EPIDEMIOLOGIC STUDIES.
18430 APTIC NO. 36222

I

**IANNIBELLO A**
CATALYTIC HYDRODESULFURIZATION OF PETROLEUM RESIDUES: FIXED AND SUSPENSION-BED PROCEDURES.
18000 APTIC NO. 36525

**IEROKOMOS N**
ION PUMP - VOLUME 2 OF 6 COMBINED STUDY PROGRAM. (FINAL REPORT).
*18155 APTIC NO. 36420

**IHARA S**
DETERMINATION OF PAN.
18185 APTIC NO. 36832

**IHARA Y**
OXIDATION OF SO2 BY PARTICULATES COLLECTED ON FILTERS.
18322 APTIC NO. 36501

**IKEDA H**
AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.
18499 APTIC NO. 3630[illegible]

**IKEDA K**
STUDIES OF VEHICLE EXHAUST INTENSITY.
*17935 APTIC NO. 37204

**IKEDA Y**
AIR POLLUTION OF URBAN SCALE AND METEOROLOGICAL FACTOR.
*18302 APTIC NO. 36492

**IKEGAYA H**
AIR POLLUTION BY FERRO ALLOY OPEN TYPE ELECTRIC FURNACE.
*18044 APTIC NO. 36908

**IKEJIRI H**
IMPRESSIONS.
*18507 APTIC NO. 36333

**IKI S**
SOIL CONTAMINATION BY HEAVY METALS IN ATMOSPHERIC DEPOSIT IN KITAKYUSHU CITY.
17981 APTIC NO. 36846

**IKO K**
INVESTIGATION OF ACUTE INFLUENCES.
*18424 APTIC NO. 36830

**IMAGAMI K**
CUPOLA STACK GAS CONCENTRATION MEASUREMENT AND DUST COLLECTION.
18208 APTIC NO. 36822

**IMAHASHI T**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
18272 APTIC NO. 36293

**INCULET I I**
ELECTROSTATIC CHARGING AND DISSIPATION OF DUST CLOUDS IN ENCLOSED ROOMS.
*18045 APTIC NO. 36117

**INOUE H**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843
THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**INOUE T**
METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I).
18317 APTIC NO. 36310

**INUGAMI M**
DETERMINATION OF OZONE USING CHEMILUMESCENCE.
18187 APTIC NO. 37212

**IONESCU A L**
CONSIDERATIONS ON THE EFFECTS OF ATMOSPHERE IMPURIFICATION UPON THE FLORA AND VEGETATION OF THE COPSA MICA REGION.
*18459 APTIC NO. 36803

**IRELAND F E**
DETERMINING THE HEIGHT OF CHIMNEYS IN GREAT BRITAIN.
*18046 APTIC NO. 36827

**ISAAC P C G**
CONTINENTAL REPORT: AFRICA.
*17936 APTIC NO. 36391

**ISAEVA N M**
CHEMISORPTION OF HYDROGEN SULFIDE AND SULFUR DIOXIDE BY A WEAK ALKALINE SOLUTION IN A TURBULENT APPARATUS.
18059 APTIC NO. 36239

**ISHIDA K**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
*18303 APTIC NO. 37198

THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**ISHIGURO H**
IMPRESSIONS.
*18508 APTIC NO. 36334

**ISHIGURO T**
EVALUATION OF ODOR POLLUTION.
18167 APTIC NO. 36468

OBSERVATION ON THE BASIC INVESTIGATION METHOD FOR BAD ODOR FROM THE STANDPOINT OF ON-SITE TESTS. (A SEQUEL).
18150 APTIC NO. 36894

AN EXAMPLE OF INVESTIGATION METHODS FOR ODOR POLLUTION.
18244 APTIC NO. 36910

**ISHIHARA Y**
IMPRESSIONS.
*17964 APTIC NO. 36312

**ISHII T**
STUDY ON MEASUREMENT OF AUTOMOTIVE EXHAUSTS.
*18156 APTIC NO. 37183

**ISHIKAWA K**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**ISHIKAWA S**
THE EMPHYSEMA PROFILE IN TWO MIDWESTERN CITIES IN NORTH AMERICA.
*18425 APTIC NO. 36400

**ISHIKAWA T**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**ISHIKAWA Y**
AN ANALYSIS OF AIR POLLUTION AND METEOROLOGICAL ELEMENTS IN OSAKA.
18320 APTIC NO. 36307

**ISHIWATARI K**
IMPRESSIONS.
*18509 APTIC NO. 36336

**ISRAEL G W**
DYNAMICAL PROPERTIES OF AEROSOL BEAMS.
*18157 APTIC NO. 36341

**ITO E**
ON CONTENTS OF SUSPENDED PARTICULATES IN THE ATMOSPHERE OF URBAN AREA.
18247 APTIC NO. 36474

ON MEASUREMENT OF CARBON DISULFIDE AROUND A FACTORY.
*18158 APTIC NO. 36544

**ITO M**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
18272 APTIC NO. 36293

AIR POLLUTION FORECASTING PROGRAM.
*18304 APTIC NO. 36308

SOME STUDIES ABOUT FORECASTING OF PHOTOCHEMICAL SMOG.
18316 APTIC NO. 37192

**ITO S**
AUTOMATIC ANALYZER FOR OXIDE OF NITROGEN IN STACK.
18178 APTIC NO. 37157

**ITOU M**
THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

**IWASAKI Y**
EVALUATION OF ODOR POLLUTION.
18167 APTIC NO. 36468

STUDIES OF CO PROFILE AROUND THE CROSSROADS.
18259 APTIC NO. 36502

**IWATA G**
ON THE DIFFUSION WHEN THE LAYER FLUX-ZERO IS ABOVE THE SOURCE.
18333 APTIC NO. 36488

**IZUMIKAWA S**
DISCUSSION OF NEUTRAL KI METHOD FOR OXIDANT.
*18159 APTIC NO. 36498

DETERMINATION OF PAN IN ATMOSPHERE.
18202 APTIC NO. 37206

J

**JAEGER M J**
LOOP FORMATION IN PRESSURE VS. FLOW DIAGRAMS OBTAINED BY BODY PLETHYSMOGRAPHIC TECHNIQUES.
*18426 APTIC NO. 36267

**JASKULLA N**
THE REDUCTION OF CARCINOGENIC CONTAMINANTS IN EXHAUST GASES OF PETROL ENGINES THROUGH FUEL ADDITIVES AND CHOICE OF LUBRICANTS.
18042 APTIC NO. 36437

**JECH J**
THE RELATIONSHIP OF AIR POLLUTION TO VALUES OF FORCED EXPIRATORY VOLUME IN TEN-YEAR-OLD CHILDREN.
*18427 APTIC NO. 36047

**JELGERSMA J H N**
INVESTIGATION INTO CORROSION IN THE ELECTRO-FILTERS OF GARBAGE INCINERATION PLANT.
*18475 APTIC NO. 36828

**JOHNSON R H**
EFFECT OF UNLEADED FUEL ON LUBRICANT PERFORMANCE.
17923 APTIC NO. 36080

**JOHNSTON H**
CATALYTIC REDUCTION OF STRATOSPHERIC OZONE BY NITROGEN OXIDES.
*18305 APTIC NO. 36112

**JONES J H**
PROCESS FOR EXHAUST GAS CLEANING.
*18047 APTIC NO. 36302

**JOUBERT J**
A NEW DUST COLLECTOR USING ELECTROSTATICALLY SPRAYED WATER.
18017 APTIC NO. 36395

**JULIAN A**
STUDY OF VARIOUS APPARATUS FOR THE DETERMINATION OF ALTITUDE OF AEROSOLS.
*18160 APTIC NO. 36178

**JUNGE C E**
COMMENTS ON CONCENTRATION AND SIZE DISTRIBUTION MEASUREMENTS OF ATMOSPHERIC AEROSOLS AND A TEST OF THE THEORY OF SELF-PRESERVING SIZE DISTRIBUTION.
*18365 APTIC NO. 36328

K

**KACHI S**
THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
*18306 APTIC NO. 37211

**KAJI S**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
18272 APTIC NO. 36293

RELATION BETWEEN AIR POLLUTION AND DIURNAL RANGE OF AIR TEMPERATURE IN ICHIARA DISTRICT.
18351 APTIC NO. 36289

**KAMATA K**
ON THE ENVIRONMENTAL CONDITIONS OF THE SURVEY POINT HEAVILY CONTAMINATED BY THE AUTOMOTIVE EXHAUST GAS.
18235 APTIC NO. 37165

**KANAMARU T**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**KANDELL P**
METHOD OF REMOVING NITROGEN OXIDES FROM GASES.
*18048 APTIC NO. 36866

**KANEKO Y**
RELATION BETWEEN AIR POLLUTION AND DIURNAL RANGE OF AIR TEMPERATURE IN ICHIARA DISTRICT.
18351 APTIC NO. 36289

**KANNO S**
VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR.
18318 APTIC NO. 36487
STUDIES ON AUTO-EXHAUST GAS POLLUTION IN KANAGAWA PREFECTURE.
18253 APTIC NO. 36504
METEOROLOGICAL STUDIES ON THE AIR POLLUTION AT KEIHIN INDUSTRIAL REGION IN WINTER.
18348 APTIC NO. 36807

**KAPLAN E**
LEAD POISONING IN CHILDHOOD - COMPREHENSIVE MANAGEMENT AND PREVENTION.
18397 APTIC NO. 36207

**KARPOVA T B**
EFFECT OF MINERAL NUTRITION ON THE METABOLISM OF CARBON-14 COMPOUNDS AND ON GAS RESISTANCE OF FORAGE PLANTS.
18457 APTIC NO. 36164

**KARZHAVIN V A**
PRODUCTION OF SULFUR FROM SULFUR DIOXIDE.
18115 APTIC NO. 36183

**KASHIMIZU T**
VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR.
18318 APTIC NO. 36487

**KASPER R**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**KATO S**
CATALYTIC COMBUSTION OF HYDROCARBON VAPORS.
*18049 APTIC NO. 36472
CONTROL OF THE VAPORIZED HYDROCARBON EMISSION.
18110 APTIC NO. 37197

**KATO T**
A SURVEY ON MN PARTICULATE POLLUTION AND ENVIRONMENTAL IMPROVEMENTS.
*18245 APTIC NO. 36531

**KATORI Y**
AN EXAMPLE OF INVESTIGATION METHODS FOR ODOR POLLUTION.
18244 APTIC NO. 36910

**KATZ M**
PHOTOELECTRIC DETERMINATION OF ATMOSPHERIC SULFUR DIOXIDE EMPLOYING DILUTE STARCH-IODINE SOLUTIONS.
*18161 APTIC NO. 36069

**KAWAGUCHI N**
ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
18303 APTIC NO. 37198

**KAWAI Y**
ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
18303 APTIC NO. 37198

**KAWASAKI G**
THE TREATMENT OF EXHAUST OIL VAPOUR OF HOT FORGING PROCESS.
18073 APTIC NO. 36471

**KEENE J A**
ROAD ANTIKNOCK PERFORMANCE OF LOW LEAD AND NONLEADED GASOLINES IN EUROPEAN CARS.
17917 APTIC NO. 36082

**KELLEY P H**
ORGANOLEPTIC EVALUATION. SENSORY PANEL TESTING CAN HELP PROTECT FOOD PRODUCTS FROM CHANGES OF AROMA AND FLAVOR IMPARTED BY PACKAGING MATERIALS.
18131 APTIC NO. 36101

**KENNEDY A S**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**KERIN Z**
ENVIRONMENTAL CONTAMINATION BY LEAD FROM A MINE AND SMELTER.
18405 APTIC NO. 36283

**KEUKE S**
ELECTROSTATIC PRECIPITATOR.
18064 APTIC NO. 37210

**KHAN I M**
FORMATION AND COMBUSTION OF CARBON IN A DIESEL ENGINE.
*17937 APTIC NO. 36046

**KIMBALL T L**
HIDDEN SAVINGS FROM A CLEANER AMERICA.
*18481 APTIC NO. 37181

**KIMOTO T**
MEASURING METHOD FOR OXIDANT BY ETHYLENE.
18141 APTIC NO. 36834

**KIMURA T**
AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.
18499 APTIC NO. 36306
ON THE TWO-DIMENSIONAL DISTRIBUTION DIAGRAMS OF WIND-VELOCITY AND AIR POLLUTION.
18350 APTIC NO. 36493

**KIRKPATRICK L**
THE ROLE OF THE STATE AGENCY IN AIR POLLUTION CONTROL.
*18510 APTIC NO. 36512

**KIRSCHNER A**
WET APPROACH VENTURI SCRUBBER.
18089 APTIC NO. 36870

**KISTEMAKER J**
ON THE INFLUENCE OF TEMPERATURE DISTRIBUTIONS INSIDE A GAS CENTRIFUGE.
18367 APTIC NO. 36322

**KITAOKA Y**
EXPERIMENTS ON THE THERMAL DEGRADATION OF ETHYLENE LOW POLYMER.
*17938 APTIC NO. 36274

**KITASE M**
ON CONTENTS OF SUSPENDED PARTICULATES IN THE ATMOSPHERE OF URBAN AREA.
18247 APTIC NO. 36474
ON MEASUREMENT OF CARBON DISULFIDE AROUND A FACTORY.
18158 APTIC NO. 36544

**KITTEL G**
POSSIBILITIES IN OLFACTOMETRY. FATIGUE MEASUREMENTS AMONG SMOKERS.
*18428 APTIC NO. 36105

**KIYAMA A**
EFFECT OF O2 CONTENT ON NO DETERMINATION IN FLUE GASES.
*18162 APTIC NO. 36860

**KIYOURA R**
ENERGY AND POLLUTION -- DEVELOPMENT OF POLLUTION-FREE FUEL.
*17939 APTIC NO. 37166

**KIZLAUSKAS K**
FUEL TANK VAPOR RECOVERY CONTROL.
*18050 APTIC NO. 36871

**KLAPPENBACH E W**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**KNAUER A**
THE AIR HYGIENE PROBLEM IN THE GERMAN DEMOCRATIC REPUBLIC.
17934 APTIC NO. 36381

**KNOCHE A**
ENVIRONMENTAL PROTECTION IS A CONSTITUTIONAL REQUIREMENT. THE NEW LAW OF THE GERMAN DEMOCRATIC REPUBLIC.
*18511 APTIC NO. 36539

**KNOPOV J T**
METHOD AND APPARATUS FOR THE QUANTITATIVE MEASUREMENT OF CERTAIN COMPONENTS OF A GAS MIXTURE.
18125 APTIC NO. 36801

**KNOTT D R J**
THE HEENAN AEROPUR ELECTROFILTER.
*18051 APTIC NO. 36424

**KOBAYASHI A**
EVALUATION OF ODOR POLLUTION.
18167 APTIC NO. 36468

# AUTHOR INDEX

**KOBAYASHI Y**
URBAN AIR POLLUTION BY LEAD - YOKOHAMA AND VICINITY.
*18246 APTIC NO. 36820

**KOBAYSASHI S**
METHOD AND CATALYST FOR THE PURIFICATION OF WASTE GAS CONTAINING CARBON MONOXIDE.
*18052 APTIC NO. 36298

**KOEHLER W**
METHODS FOR THE ABATEMENT OF AIR POLLUTION CAUSED BY CEMENT PLANTS.
*18053 APTIC NO. 36393

**KOGAN A**
METHOD AND APPARATUS FOR MEASUREMENT OF CONCENTRATION OF A GAS IN A GAS MIXTURE.
*18163 APTIC NO. 36901

**KOGO T**
ON THE ENVIRONMENTAL CONDITIONS OF THE SURVEY POINT HEAVILY CONTAMINATED BY THE AUTOMOTIVE EXHAUST GAS.
18235 APTIC NO. 37165

**KOGURE N**
CUPOLA STACK GAS CONCENTRATION MEASUREMENT AND DUST COLLECTION.
18208 APTIC NO. 36822

**KOIKE K**
AIR POLLUTION DUE TO SO2 IN NAGOYA.
18343 APTIC NO. 36848
INVESTIGATION OF AIR POLLUTION IN SOUTHERN AREA OF NAGOYA.
18273 APTIC NO. 37186

**KOISO N**
CONTAMINATION CONTROL.
18215 APTIC NO. 37178

**KOLIKOVSKI P**
ON THE QUESTION ABOUT THE PRACTICAL APPLICATION OF THE INDICATOR TUBES.
*18164 APTIC NO. 36182

**KOLLER K**
PROCESS FOR THE DESULFURIZATION OF INDUSTRIAL GASES IN CLOSED CYCLE WITH SIMULTANEOUS EXTRACTION OF PURE SULFUR.
18043 APTIC NO. 36170

**KOLMESCHATE G J V**
MERCURY IN THE ENVIRONMENT - TECHNIQUES OF ANALYSIS.
*18165 APTIC NO. 36826

**KOMAROVSKIY M S**
FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL.
18477 APTIC NO. 36804

**KOMEIJI T**
STUDIES OF CO PROFILE AROUND THE CROSSROADS.
18259 APTIC NO. 36502

**KONDO E**
ODOR CONTROL OF ACRYLIC ESTERS.
*18054 APTIC NO. 36467

**KONDO J**
ANALYSIS OF POLLUTION CAUSED BY AUTOMOTIVE EXHAUST GAS.
*18307 APTIC NO. 37208

**KONDO M**
ELECTROSTATIC PRECIPITATOR.
18064 APTIC NO. 37210

**KONDO R**
IMPRESSIONS.
*18512 APTIC NO. 36315

**KOOIJ J V**
THE EMISSION OF NITROGEN OXIDES.
*17940 APTIC NO. 36044

**KOP M**
ENVIRONMENTAL CONTAMINATION BY LEAD FROM A MINE AND SMELTER.
18405 APTIC NO. 36283

**KOSHIMIZU T**
STUDIES ON AUTO-EXHAUST GAS POLLUTION IN KANAGAWA PREFECTURE.
18253 APTIC NO. 36504

**KOSTINA E N**
METHOD AND APPARATUS FOR THE QUANTITATIVE MEASUREMENT OF CERTAIN COMPONENTS OF A GAS MIXTURE.
18125 APTIC NO. 36801

**KOTHNY E L**
SUB-MINUTE CONTINUOUS NITROGEN DIOXIDE ANALYSIS.
*18166 APTIC NO. 36383

**KOTSEV E I**
FORMATION OF CONDENSATION AEROSOLS UNDER RAPIDLY CHANGING ENVIRONMENTAL CONDITIONS. NON-COAGULATED, HIGH-DISPERSED AEROSOLS.
18341 APTIC NO. 36039

**KOYAMA I**
EVALUATION OF ODOR POLLUTION.
*18167 APTIC NO. 36468
STUDIES OF CO PROFILE AROUND THE CROSSROADS.
18259 APTIC NO. 36502

**KREYBERG L**
THE OCCURRENCE OF LUNG CANCER IN NORWAY.
*18429 APTIC NO. 36462

**KUBO K**
ON CONTENTS OF SUSPENDED PARTICULATES IN THE ATMOSPHERE OF URBAN AREA.
*18247 APTIC NO. 36474
ON MEASUREMENT OF CARBON DISULFIDE AROUND A FACTORY.
18158 APTIC NO. 36544

**KUBO Y**
EFFECT OF O2 CONTENT ON NO DETERMINATION IN FLUE GASES.
18162 APTIC NO. 36860
ATMOSPHERIC SULFUR OXIDES DETERMINATION BY ATOMIC ABSORPTION METHOD.
*18168 APTIC NO. 37205

**KUBOTA K**
ANALYSIS OF DRIVING PATTERN IN TOKYO.
*17941 APTIC NO. 36505

**KUCHERYAVYY E N**
FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL.
18477 APTIC NO. 36804

**KUELSKE S**
SMOG ALARM SERVICE IN NORDRHEIN-WESTFALEN FROM OCTOBER 30, 1967 TILL OCTOBER 27, 1968.
18261 APTIC NO. 36414

**KULHANEK F C**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**KUMADA Y**
IMPRESSIONS.
*18513 APTIC NO. 36313

**KUMAI K**
STUDIES ON THE ERRORS OF SULFUR DIOXIDE DETERMINATION IN THE ATMOSPHERE BY WEST-GAEKE METHOD.
18206 APTIC NO. 36097

**KUMAI M**
FOG MODIFICATION STUDIES ON THE GREENLAND ICE CAP.
*18308 APTIC NO. 36357

**KUMAZAKI O**
SOME ASPECTS ON POLLUTED GASES EMITTED FROM KEROSENE BURNING STOVE.
17980 APTIC NO. 36500

**KUMAZAWA Y**
AN ANALYSIS OF AIR POLLUTION AND METEOROLOGICAL ELEMENTS IN OSAKA.
18320 APTIC NO. 36307

**KURCZATOWA G**
MODIFICATION OF THE PHENOL-HYPOCHLORITE METHOD OF AMMONIA DETERMINATION IN ATMOSPHERIC AIR.
*18169 APTIC NO. 36303

**KURIMOTO J**
IMPRESSIONS.
*18514 APTIC NO. 36332

**KURODA D**
PROBLEMS OF TOXIC GAS SAMPLING.
*18170 APTIC NO. 36824
QUANTITATIVE ANALYSIS OF NITROGEN OXIDES IN ATMOSPHERE. REPORT NO.6. NO PLUS NO2 COLLECTION BY ALKALINE ABSORBENT.
*18171 APTIC NO. 37194

**KURODA H**
HEAT CAPACITY CHANGES PREDICT NITROGEN OXIDES REDUCTION BY EXHAUST GAS RECIRCULATION.
18075 APTIC NO. 36158

**KUSUYA Y**
CONCENTRATION OF VANADIUM IN ATMOSPHERIC PARTICULAR MATTER.
18262 APTIC NO. 36849

**KUZMINA F S**
SOME INDICES OF LIPID METABOLISM IN THE BLOOD OF WORKERS ENGAGED IN COPPER WORKS.
18388 APTIC NO. 36517

L

**LAAMANEN A**
THE AIR POLLUTION SITUATION AND SPECIAL PROBLEMS IN FINLAND.
*17942 APTIC NO. 36423

**LAFFERTY W L JR**
ALKYLATIN AND ISOMERIZATION.
*17943 APTIC NO. 36535

**LAGARIAS J S**
THE OPERATION OF THE TECHNICAL COMMITTEES OF THE AIR POLLUTION CONTROL ASSOCIATION (U.S.A.).
*18515 APTIC NO. 36387

**LAGO A M**
AIR POLLUTION IMPACTS.
18014 APTIC NO. 36344

**LAMBERT J R**
ENVIRONMENTAL STATEMENT. HILL AIR FORCE BASE, UTAH.
*17944 APTIC NO. 36135

**LAMBREVA E**
ON THE QUESTION ABOUT THE PRACTICAL APPLICATION OF THE INDICATOR TUBES.
18164 APTIC NO. 36182

**LANG R J**
A WELL-MIXED THERMAL REACTOR SYSTEM FOR AUTOMOTIVE EMISSION CONTROL.
*18055 APTIC NO. 36074

**LANGER G**
PARTICLE DEPOSITION AND REENTRAINMENT FROM CONIFEROUS TREES. PART II. EXPERIMENTS WITH INDIVIDUAL LEAVES.
*18460 APTIC NO. 36401
EVALUATION OF NCAR ICE AND CLOUD CONDENSATION NUCLEUS COUNTERS.
*18172 APTIC NO. 36416

**LANGNESS P S**
AIR CLEANER FOR INTERNAL COMBUSTION ENGINE.
*18056 APTIC NO. 36913

**LANSCHE A M**
SULFUR AND PYRITES.
*17945 APTIC NO. 36221

**LAPP N L**
EVALUATION OF LUNG MECHANICS IN EPIDEMIOLOGIC STUDIES.
*18430 APTIC NO. 36222

**LARSEN R I**
DETERMINING SOURCE REDUCTION NEEDED TO MEET AIR QUALITY STANDARDS.
*18487 APTIC NO. 36382

**LAUDIEN K**
THE OUTDOOR AND INDOOR FREQUENCY DISTRIBUTION AND CONCENTRATION OF AEROSOLS.
*18248 APTIC NO. 37169

**LAWTHER P J**
CHRONIC BRONCHITIS AND AIR POLLUTION.
*18431 APTIC NO. 36465

**LEBLANC F**
FLUORIDE INJURY SYMPTOMS IN EPIPHYTIC LICHENS AND MOSSES.
*18461 APTIC NO. 36883

**LEITER J**
PRODUCTION OF SUBCUTANEOUS SARCOMAS IN MICE WITH TARS EXTRACTED FROM ATMOSPHERIC DUSTS.
*18432 APTIC NO. 36459

**LENANE D L**
COMPOSITION, SIZE AND CONTROL OF AUTOMOTIVE EXHAUST PARTICLATES.
17975 APTIC NO. 37176

**LEROY B**
AIRCRAFT OZONOMETER.
*18173 APTIC NO. 36256

**LESTZ S S**
AN EMPIRICAL MODEL FOR CORRELATING CYCLE-BY-CYCLE CYLINDER GAS MOTION AND COMBUSTION VARIATIONS OF A SPARK IGNITION ENGINE.
17915 APTIC NO. 36127

**LEVIN L M**
ON THE GROWTH OF DROPLETS BY CONDENSATION ON HYGROSCOPIC NUCLEI.
18278 APTIC NO. 36142

**LEVINS P L**
ON A CLEAR DAY.
*18309 APTIC NO. 36426

**LIIMATTA D R**
EFFECTS OF MIXTURE DISTRIBUTION ON EXHAUST EMISSIONS AS INDICATED BY ENGINE DATA AND THE HYDRAULIC ANALOGY.
*17946 APTIC NO. 36116

**LINDSAY R**
INFLUENCE OF HOMOGENEOUS CHARGE ON THE EXHAUST EMISSIONS OF HYDROCARBONS, CARBON MONOXIDE, AND NITRIC OXIDE FROM A MULTICYLINDER ENGINE.
*18057 APTIC NO. 36081

**LINDSEY A J**
POLYCYCLIC HYDROCARBONS IN TOBACCO SMOKE: PIPE SMOKING EXPERIMENTS.
17928 APTIC NO. 36359
POLYCYCLIC HYDROCARBONS IN CIGARETTE SMOKE.
18135 APTIC NO. 36372
ATMOSPHERIC POLLUTION BY POLYCYCLIC HYDROCARBONS.
18234 APTIC NO. 36399

**LODGE J P JR**
SPECIFIC METHOD FOR THE DETERMINATION OF ZONE IN THE ATMOSPHERE.
18192 APTIC NO. 36887

**LODI G**
INSTALLATION FOR THE WASHING OF INDUSTRIAL GASES. NOTE I INFLUENCE OF THE TYPE OF PACKING SURFACE ON THE FLOW DYNAMICS OF THE ABSORBER.
18018 APTIC NO. 36526

**LONG R**
GAS CHROMATOGRAPHIC ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN SOOT SAMPLES.
18132 APTIC NO. 36464

**LORENZI A**
CHARACTERISTICS OF POROUS WALLS FOR MEASURING LOW GAS FLOW-RATES.
*18366 APTIC NO. 37167

**LORETI F**
EXPERIMENTAL CHRONIC TOXICITY SUBSEQUENT TO THE INHALATION OF MERCURY VAPORS.
*18433 APTIC NO. 36231

**LOS J**
THE SEPARATIVE POWER OF SHORT COUNTERCURRENT CENTRIFUGES.
18372 APTIC NO. 36319
ON THE INFLUENCE OF TEMPERATURE DISTRIBUTIONS INSIDE A GAS CENTRIFUGE.
*18367 APTIC NO. 36322

**LOUGHER E H**
SO2 PICKUP BY LIMESTONE AND DOLOMITE PARTICLES IN FLUE GAS.
18010 APTIC NO. 36455

**LOWRY W P**
TRENDS IN VISIBILITY AT SALEM, OREGON, 1958-1967.
18229 APTIC NO. 36236

**LUTZ M**
PRELIMINARY STUDY OF RAPID CHROMATOGRAPHIC ANALYSIS OF THE PERMANENT GAS CONSTITUENTS OF AIR.
*18174 APTIC NO. 36479

**LYNN W R**
MANAGING THE ENVIRONMENT.
*18516 APTIC NO. 36132

M

**MACKENZIE V G**

NEW STEPS TO MINIMIZE THE HAZARDS OF AIR POLLUTION – FOR PUBLIC AND VOLUNTARY AGENCIES: FOR THE DOCTOR AND HIS PATIENT.
*18529 APTIC NO. 36154

**MACNAB G**

HEMOLYSIS BY ASBESTOS.
18420 APTIC NO. 36276

**MAESHIMA T**

TREATMENT OF HYDROGEN SULFIDE GAS AT TAGONOURA HARBOR.
18091 APTIC NO. 37200

**MAHADEVAN T N**

SPECTROPHOTOMETRIC METHOD FOR THE STANDARDIZATION OF SULPHIDE RADICALS IN SOLUTION.
18217 APTIC NO. 36167

ENVIRONMENTAL CONCENTRATIONS OF SOME OF THE MAJOR INORGANIC POLLUTANTS AT THE BARC SITE, TROMBAY, BOMBAY.
18274 APTIC NO. 36168

AIR POLLUTION STUDIES IN TROMBAY REGION.
18275 APTIC NO. 36237

**MAKI S**

AN ANALYSIS OF AIR POLLUTION AND METEOROLOGICAL ELEMENTS IN OSAKA.
18320 APTIC NO. 36367

**MAKINO K**

THE CORRELATION BETWEEN OXIDANTS AND VARIOUS FACTOR.
18313 APTIC NO. 36851

**MAKISHIMA S I**

DISCHARGE RATE OF SOLID PARTICLES THROUGH ORIFICE WITH COCURRENT STREAM OF GAS.
*18368 APTIC NO. 36223

**MALOOF C A**

URINARY EXCRETION OF LEAD IN CHILDREN.
18393 APTIC NO. 36288

**MAMMARELLA L**

ATMOSPHERIC STABILITY AND AEROSOL POLLUTION. (PROPOSAL OF A SIMPLE METHOD FOR EVALUATING THE CONDITIONS OF AIR STABILITY.
*18310 APTIC NO. 36238

**MAPSTON R T**

THE OPERATION OF THE TECHNICAL COMMITTEES OF THE AIR POLLUTION CONTROL ASSOCIATION (U.S.A.).
18515 APTIC NO. 36387

**MARTIN A**

SULPHUR DIOXIDE CONCENTRATIONS MEASURED AROUND A MODERN POWER STATION.
18239 APTIC NO. 36384

**MARTIN B E**

A STABLE OZONE SOURCE APPLICABLE AS A SECONDARY STANDARD FOR CALIBRATION OF ATMOSPHERIC MONITORS.
18363 APTIC NO. 36107

**MARTIN G B**

AN INVESTIGATION OF THE CONVERSION OF VARIOUS FUEL NITROGEN COMPOUNDS TO NITROGEN OXIDES IN OIL COMBUSTION.
*17947 APTIC NO. 36126

**MASSIMONO D**

PRELIMINARY STUDY OF RAPID CHROMATOGRAPHIC ANALYSIS OF THE PERMANENT GAS CONSTITUENTS OF AIR.
18174 APTIC NO. 36479

**MASTEROV A P**

METHODS FOR REDUCTION OF THE AMOUNT OF TOXIC GASEOUS EFFLUENTS DISCHARGED INTO THE ATMOSPHERE AND PURIFICATION OF SEWAGE WATERS IN THE PRODUCTION OF METHANOL.
*17948 APTIC NO. 36232

**MASUDA H**

AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.
18499 APTIC NO. 36386

**MATSUI T**

AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**MATSUMOTO K**

PRESENT STATE OF COUNTERMEASURE FOR EXHAUST GAS FROM GASOLINE ENGINES.
*18058 APTIC NO. 37195

**MATSUMURA T**

AIR POLLUTION AS MEASURED BY AUTOMATIC ANALYZER (VII).
*18249 APTIC NO. 36888

**MATSUMURA Y**

SOME PROBLEMS ON THE CHEMICAL ANALYSIS OF SULFURIC ACID MIST.
*18175 APTIC NO. 36857

**MATSUO K**

TRACE METALS IN SUSPENDED PARTICULATES (VII).
18242 APTIC NO. 36499

ATMOSPHERIC CONCENTRATION OF SULFUR OXIDES IN OSAKA PREFECTURE.
18237 APTIC NO. 36842

**MATSUOKA S**

FACTORS INFLUENCING THE CYCLIC VARIATION OF COMBUSTION OF SPARK IGNITION ENGINE.
*17949 APTIC NO. 36113

**MATSUSHITA H**

SHORT TERM DETERMINATION OF BENZO(A)PYRENE IN TARRY MATERIALS.
*18176 APTIC NO 37215

**MATSUURA A**

EXHAUST AMMONIA TREATMENT IN A FERTILIZER PLANT.
18063 APTIC NO. 36475

VARIATION OF CONCENTRATION BETWEEN SULFUR DIOXIDE AND PARTICLES.
*18369 APTIC NO. 37213

**MATSUURA Y**

THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

**MATUO K**

THE ESTIMATION OF DIFFUSION FROM THE AREA-SOURCES.
18340 APTIC NO. 36496

**MAUZERALL D**

PORPHYRIN BIOSYNTHESIS IN ERYTHROCYTES. III. UROPORPHYRINOGEN AND ITS DECARBOXYLASE.
*18434 APTIC NO. 36190

**MAXIMOV V F**

CHEMISORPTION OF HYDROGEN SULFIDE AND SULFUR DIOXIDE BY A WEAK ALKALINE SOLUTION IN A TURBULENT APPARATUS.
*18059 APTIC NO. 36239

**MCCABE L C**

THE OPERATION OF THE TECHNICAL COMMITTEES OF THE AIR POLLUTION CONTROL ASSOCIATION (U.S.A.).
18515 APTIC NO. 36387

**MCCABE L J**

METAL LEVELS FOUND IN DISTRIBUTION SAMPLES.
*18370 APTIC NO. 36076

**MCDONALD D P**

DUST CONTROL.
*18060 APTIC NO. 36511

**MCNULTY J W**

STATE TAX INCENTIVES TO FIGHT POLLUTION.
*18517 APTIC NO. 36433

**MEENAGHAN G F**

GAS PRODUCTION FROM BEEF CATTLE WASTES.
*17950 APTIC NO. 36404

**MEIRA L G JR**

ROCKET MEASUREMENTS OF UPPER ATMOSPHERIC NITRIC OXIDE AND THEIR CONSEQUENCES TO THE LOWER IONOSPHERE.
*18311 APTIC NO. 37172

**MEL NIKOVA E A**

THE TOXICITY OF HIGHLY DISPERSED AEROSOLS OF CADMIUM OXIDE.
*18435 APTIC NO. 36407

**MELVILLE K J**

MERCURY-LADEN AIR: THE TOXIC CONCENTRATION, THE PROPORTION ABSORBED, AND THE URINARY EXCRETION.
18414 APTIC NO. 36228

**MERCER J F**
METHOD AND APPARATUS FOR REMOVING SMOG AND SMOKE.
*18061 APTIC NO. 36920

**MERENKOV K V**
THE STUDY OF PURIFICATION OF FLUE GASES FROM NITROGEN OXIDES BY KARATAU PHOSPHATE.
18060 APTIC NO. 36257

**MESZAROS A**
ON THE VARIATION OF THE SIZE DISTRIBUTION OF LARGE AND GIANT ATMOSPHERIC PARTICLES AS A FUNCTION OF THE RELATIVE HUMIDITY.
*18312 APTIC NO. 36514

**MEYER W E**
AN EMPIRICAL MODEL FOR CORRELATING CYCLE-BY-CYCLE CYLINDER GAS MOTION AND COMBUSTION VARIATIONS OF A SPARK IGNITION ENGINE.
17915 APTIC NO. 36127

**MEYERS S**
A SYSTEMS ANALYSIS STUDY OF THE INTEGRATED IRON AND STEEL INDUSTRY.
*18062 APTIC NO. 36118

**MEZIERES F A**
SCANDINAVIAN PAPER-MAKING INDUSTRY AND ENVIRONMENTAL PROTECTION.
*17952 APTIC NO. 36480

ACCOMPLISHMENTS OF THE SWEDISH PAPER INDUSTRY IN MATTERS OF ENVIRONMENTAL PROTECTION.
*17951 APTIC NO. 36049

**MIKHALSKAYA L I**
POTENTIOMETRIC DETERMINATIONS OF THE GROUP COMPOSITION OF SULFUR COMPOUNDS PRESENT IN STRAIGHT-RUN GASOLINE FRACTIONS.
17966 APTIC NO. 36533

**MIKI M**
ATMOSPHERIC SULFUR OXIDES DETERMINATION BY ATOMIC ABSORPTION METHOD.
18168 APTIC NO. 37205

**MILLER I F**
THE PERMEATION OF CARBON DIOXIDE, OXYGEN, AND NITROGEN THROUGH WEAKLY BASIC POLYMER MEMBRANES.
18100 APTIC NO. 36889

**MILLER K**
HEMOLYSIS BY ASBESTOS.
18420 APTIC NO. 36276

**MIMURA Y**
GAS CHROMATOGRAPHY OF COMBUSTION PRODUCTS.
17914 APTIC NO. 36898

**MINAKAMI M**
EXHAUST AMMONIA TREATMENT IN A FERTILIZER PLANT.
*18063 APTIC NO. 36475

EXHAUST FLUORIDES FROM GYPSUM PLANTS.
18076 APTIC NO. 37164

**MIRIBEL J**
USE OF FUMIGENS FOR THE STUDY OF VENTILATION. RECYCLING EVALUATION, MEASUREMENT OF TRANSIT TIME.
18128 APTIC NO. 36445

**MIROSHNIKOVA A G**
EXPERIENCE IN THE USE OF THE BIOCHEMOLUMINESCENCE METHOD FOR DIAGNOSING THE GAS RESISTANCE OF PLANTS.
18464 APTIC NO. 36162

**MIROSHNIKOVA A T**
GAS RESISTANCE AND CERTAIN BIOCHEMICAL CHARACTERISTICS OF ETIOLATED AND GREEN PLANTS OF FORAGE GRASSES.
18465 APTIC NO. 36163

**MITANI K**
THE STUDY OF THE MEASUREMENT OF NITROGEN OXIDES IN AIR.
*18177 APTIC NO. 36545

**MITSUDA A**
METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I).
18317 APTIC NO. 36310

**MITSUI S**
FUNDAMENTAL RESEARCH ON DEODORIZATION BY OXIDATION IN FLUIDIZED BED.
18065 APTIC NO. 37162

**MITSUMATA H**
ELECTROSTATIC PRECIPITATOR.
*18064 APTIC NO. 37210

**MITSUO I**
ANALYSIS OF DRIVING PATTERN IN TOKYO.
17941 APTIC NO. 36505

**MITSUOKA K**
THE ESTIMATION OF AUTOMOBILE EXHAUST EMISSIONS IN OSAKA.
17933 APTIC NO. 36290

**MIURA M**
FUNDAMENTAL RESEARCH ON DEODORIZATION BY OXIDATION IN FLUIDIZED BED.
*18065 APTIC NO. 37162

**MIYAZAKI K**
METHOD AND CATALYST FOR THE PURIFICATION OF WASTE GAS CONTAINING CARBON MONOXIDE.
18052 APTIC NO. 36298

**MIYAZAKI M**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
18272 APTIC NO. 36293

**MIZOGUCHI I**
THE CORRELATION BETWEEN OXIDANTS AND VARIOUS FACTOR.
*18313 APTIC NO. 36851

**MIZOGUCHI K**
AIR POLLUTION DUE TO SO2 IN NAGOYA.
18343 APTIC NO. 36848

**MIZOGUCHI T**
AN ANALYSIS OF AIR POLLUTION AND METEOROLOGICAL ELEMENTS IN OSAKA.
18320 APTIC NO. 36307

MATHEMATICAL MODEL FOR PREDICTION OF CARBON MONOXIDE CONCENTRATION BY AUTOMOBILE EXHAUST GAS.
*18314 APTIC NO. 36291

**MIZUTANI H**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

OBSERVATION FROM A TEN YEAR STUDY OF SULFUR DIOXIDE IN NAGOYA BY PB2 METHOD.
18243 APTIC NO. 37199

**MOREL R**
A NEW DUST COLLECTOR USING ELECTROSTATICALLY SPRAYED WATER.
18017 APTIC NO. 36395

**MORI M**
AUTOMATIC ANALYZER FOR OXIDE OF NITROGEN IN STACK.
*18178 APTIC NO. 37157

DETERMINATION OF OZONE USING CHEMILUMESCENCE.
18187 APTIC NO. 37212

**MORIGUCHI M**
DIFFUSION EXPERIMENT OVER AN URBAN AREA.
18335 APTIC NO. 36490

**MORIKAWA M**
MEASUREMENT OF OXIDES OF NITROGEN BY IODINE PENTOXIDE METHOD.
18126 APTIC NO. 36546

**MORIMOTO N**
AFTERBURNER TYPE EXHAUST PURIFICATION APPARATUS.
18037 APTIC NO. 36880

**MORRIS W E**
CARS AND THE NEW GASOLINES 1971.
*17953 APTIC NO. 36084

**MOSER C E**
AUTOMOTIVE EMISSIONS RESEARCH AND THE COORDINATING RESEARCH COUNCIL PROGRAM.
*18518 APTIC NO. 36131

**MOSES H**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**MOSES R J**
WHERE IS THE WATER COMING FROM? A LOOK AT COOLING TOWER WATER REQUIREMENTS IN THE WEST.
*17954 APTIC NO. 36463

**MOTOHASHI K**
EGR AS COUNTERMEASURE TO NOX IN DIESEL ENGINE.
18104 APTIC NO. 37182

**MOULDS D E**
CADMIUM.
*17965 APTIC NO. 36432

**MOURITZEN G**
OPTIMIZATION OF NEW PRACTICAL AUTOMOTIVE POWER SYSTEMS.
*17956 APTIC NO. 36230

**MUELLER IBOLD K**
THE EFFECTS OF URBAN DEVELOPMENT AND TRAFFIC ON MANO .
*18519 APTIC NO. 36542

**MUELLER P K**
ORIGIN OF LEAD IN SURFACE VEGETATION.
*18462 APTIC NO. 36197

SPUTUM HISTAMINE AND INHALATION TOXICITY. (FINAL REPORT).
18445 APTIC NO. 36199

**MUELLER W J**
AIR POLLUTION COSTS AS THEY RELATE TO THE RUBBER INDUSTRY.
18476 APTIC NO. 36108

**MUKERJI S K**
LEAF ONTOGENY AS A FACTOR IN SUSCEPTIBILITY TO OZONE: AMINO ACID AND CARBOHYDRATE CHANGES DURING EXPANSION.
18472 APTIC NO. 37170

**MUNOZ N**
AIRBORNE FUNGUS SPORES IN BOGOTA, COLOMBIA: A FIVE YEAR STUDY.
18240 APTIC NO. 36229

**MURAKAMI T**
COUNTERMEASURES TO PREVENT DUST IN LOADING AND TRANSPORTING RAW MATERIAL.
*18066 APTIC NO. 36469

**MURAKAMI Y**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
18272 APTIC NO. 36293

**MURAKI N**
PRESENT STATE OF COUNTERMEASURE FOR EXHAUST GAS FROM DIESEL ENGINE.
*18067 APTIC NO. 36899

**MURAMATSU T**
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS NO.2 COLLECTION EFFICIENCY OF THIMBLE FILTER.
18148 APTIC NO. 36840

THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS. NO. 1 STUDY ON THE IMPURITY METAL IN THIMBLE FILTER.
18184 APTIC NO. 36841

**MURATA K**
EXPERIMENTS ON THE THERMAL DEGRADATION OF ETHYLENE LOW POLYMER.
17938 APTIC NO. 36274

**MURATA M**
AIR POLUTION IN YOKKAICHI (I).
*18250 APTIC NO. 37202

**MURPHY S D**
PROTECTION BY SULFUR COMPOUNDS AGAINST THE AIR POLLUTANTS OZONE AND NITROGEN DIOXIDE.
18489 APTIC NO. 36224

**MUTO K**
IMPRESSIONS.
*18530 APTIC NO. 36314

## N

**NABIEVA Z M**
THE STUDY OF PURIFICATION OF FLUE GASES FROM NITROGEN OXIDES BY KARATAU PHOSPHATE.
*18068 APTIC NO. 36257

**NAGAI T**
STUDY OF THE INFLUENCE OF HYDROGEN SULFIDE (I). A SIMPLE METHOD FOR THE HYDROGEN SULFIDE PAPER BADGE.
ERROR

**NAGAMOTO C T**
PARTICLE DEPOSITION ON AND REENTRAINMENT FROM CONIFEROUS TREES. PART I: EXPERIMENTS WITH TREES.
18469 APTIC NO. 36374

**NAGANO T**
STUDY OF THE INFLUENCE OF HYDROGEN SULFIDE (I). A SIMPLE METHOD FOR THE HYDROGEN SULFIDE PAPER BADGE.
ERROR

**NAGAOKA M**
DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (II) SOME QUESTIONS FOR DETERMINATION OF HYDROCARBONS BY THE HYDROCARBON ANALYZER.
18205 APTIC NO. 36836

**NAGAREWARI S**
A SURVEY ON MN PARTICULATE POLLUTION AND ENVIRONMENTAL IMPROVEMENTS.
18245 APTIC NO. 36531

**NAGATA R**
ON HEAVY METALS IN SUSPENDED PARTICULATE AND LOCAL CHARACTERISTICS IN TOKYO.
*18251 APTIC NO. 37191

**NAGIEV A M**
NEW ABSORBENTS AND CLASSIFICATION OF METHODS OF REMOVING SULPHUR DIOXIDE FROM INDUSTRIAL GASES.
*18069 APTIC NO. 36151

**NAITO H**
AIR POLLUTION FORECASTING PROGRAM.
18304 APTIC NO. 36308

SOME STUDIES ABOUT FORECASTING OF PHOTOCHEMICAL SMOG.
18316 APTIC NO. 37192

**NAITO M**
MATHEMATICAL MODEL FOR PREDICTION OF CARBON MONOXIDE CONCENTRATION BY AUTOMOBILE EXHAUST GAS.
18314 APTIC NO. 36291

**NAKA K**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**NAKAAKI K**
ON THE AIR POLLUTION IN SUBTERRANEAN PARKING PLACE.
18263 APTIC NO. 36503

**NAKAGAWA S**
STACK GAS DESULFURIZATION AND LIQUID WASTE PURIFICATION METHOD USING LIME.
*18070 APTIC NO. 36297

**NAKAGAWA Y**
EXHAUST FLUORIDES FROM GYPSUM PLANTS.
18076 APTIC NO. 37164

**NAKAJIMA C**
PREDICTION OF AIR POLLUTION POTENTIAL IN KYOTO.
*18315 APTIC NO. 36495

**NAKAJIMA Y**
HEAT CAPACITY CHANGES PREDICT NITROGEN OXIDES REDUCTION BY EXHAUST GAS RECIRCULATION.
18075 APTIC NO. 36158

**NAKAMURA K**
AIR POLLUTION FORECASTING PROGRAM.
18304 APTIC NO. 36308

AUTOMATIC MEASURING APPARATUS OF SO3 MIST IN AIR.
*18180 APTIC NO. 36905

INVESTIGATION OF AIR POLLUTION IN SOUTHERN AREA OF NAGOYA.
18273 APTIC NO. 37186

SOME STUDIES ABOUT FORECASTING OF PHOTOCHEMICAL SMOG.
*18316 APTIC NO. 37192

THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**NAKAMURA M**
TRACE METALS IN SUSPENDED PARTICULATES.
*18252 APTIC NO. 36486

**NAKANO K**
DISCUSSION OF NEUTRAL KI METHOD FOR OXIDANT.
18159 APTIC NO. 36498

RESEARCH ON REGIONAL REPRESENTABILITY OF SO2 CONCENTRATION.
18228 APTIC NO. 36805

**NAKANO M**

METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I).

*18317 APTIC NO. 36310

**NAKANO T**

AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.

18499 APTIC NO. 36306

**NAKANO W**

INVESTIGATION ON THE AIR POLLUTION IN MIYAKO DISTRICT.

18264 APTIC NO. 36806

**NAKAO M**

AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.

18499 APTIC NO. 36306

**NAKASHIMA T**

ON THE ENVIRONMENTAL CONDITIONS OF THE SURVEY POINT HEAVILY CONTAMINATED BY THE AUTOMOTIVE EXHAUST GAS.

18235 APTIC NO. 37165

**NAKATSUJI N**

METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I).

18317 APTIC NO. 36310

**NAKAYAMA M**

AIR POLLUTION CONTROL AND ITS EVALUATION OF THE SEVERAL CITIES IN YAMAGUCHI PREFECTURE.

18437 APTIC NO. 36809

**NAKAYAMA N**

INVESTIGATION OF ACUTE INFLUENCES.

18424 APTIC NO. 36830

**NAKAZAWA M**

VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR.

*18318 APTIC NO. 36487

STUDIES ON AUTO-EXHAUST GAS POLLUTION IN KANAGAWA PREFECTURE.

*18253 APTIC NO. 36504

**NASHIMA T**

DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (I) DECISION AND STABILITY OF STANDARD VALUE OF CALIBRATION GASES.

18182 APTIC NO. 36839

**NASU C**

INVESTIGATION OF ACUTE INFLUENCES.

18424 APTIC NO. 36830

**NEAL R C**

DOES MAN S RELEASE OF ENERGY CONTRIBUTE TO THE MELTING OF THE POLAR ICE CAPS OR DOES IT MOVE THE EARTH TOWARD ANOTHER ICE AGE? Preprint, American Society of Mechanical Engineers, New York, 4p., 1970. 4 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, New York, Nov. 29- Dec. 3, 1970, Paper 70-WA/APC-1.)

*18319 APTIC NO. 36436

LEAD LEVELS IN DECIDUOUS TEETH OF URBAN AND SUBURBAN AMERICAN CHILDREN.

*18436 APTIC NO. 36534

**NELSON D M**

CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).

18501 APTIC NO. 36342

**NELSON E**

CONTROL OF AUTOMOTIVE AIR POLLUTON.

*18071 APTIC NO. 36523

**NELSON G O**

A FIELD INSTRUMENT FOR DETECTING AIRBORNE HALOGEN COMPOUNDS.

*18181 APTIC NO. 36888

**NELSON L B**

WILL EAGERNESS FOR POLLUTION CONTROL AFFECT FERTILIZER MARKET? Croplife, 1970:25-28, Jan. 1970.

*18072 APTIC NO. 36405

ON THE 3,4-BENZPYRENE CONTENT IN THE ATMOSPHERE OF BIG INDUSTRIAL CENTERS OF KAZAKHSTAN.

*18254 APTIC NO. 36181

**NEMES G**

METHOD OF REMOVING NITROGEN OXIDES FROM GASES.

18048 APTIC NO. 36866

**NEMOTO I**

STUDIES ON PERFORMANCE TEST METHOD FOR EXHAUST GAS TREATMENT CATALYST REACTOR (REPORT 3), EXAMINATION OF CONDITIONS FOR CATALYST ACTIVITY TEST.

18031 APTIC NO. 36301

**NIHEI H**

CONTROL OF VEHICLE EXHAUST GAS IN THE CASE OF MUNICIPAL GOVERNMENT.

*18520 APTIC NO. 36506

**NIKOLAYEVSKIY V S**

PHYSIOLOGICAL-BIOCHEMICAL PRINCIPLES OF THE GAS RESISTANCE OF PLANTS.

*18463 APTIC NO. 36159

EFFECTS OF MINERAL NUTRITION ON CERTAIN PHYSIOLOGICAL-BIOCHEMICAL CHARACTERISTICS AND GAS RESISTANCE OF FORAGE GRASSES.

18473 APTIC NO. 36161

EXPERIENCE IN THE USE OF THE BIOCHEMOLUMINESCENCE METHOD FOR DIAGNOSING THE GAS RESISTANCE OF PLANTS.

*18464 APTIC NO. 36162

GAS RESISTANCE AND CERTAIN BIOCHEMICAL CHARACTERISTICS OF ETIOLATED AND GREEN PLANTS OF FORAGE GRASSES.

*18465 APTIC NO. 36163

METABOLISM OF CARBON-14 COMPOUNDS IN FORAGE GRASSES AND THE EFFECT OF SULFUR DIOXIDE ON IT.

*18466 APTIC NO. 36165

EFFECT OF SULFUR DIOXIDE ON PIGMENTS OF FORAGE GRASS.

*18467 APTIC NO. 36166

**NISHIDA K**

THE ESTIMATION OF AUTOMOBILE EXHAUST EMISSIONS IN OSAKA.

17933 APTIC NO. 36290

**NISHIDA M**

AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.

18499 APTIC NO. 36306

INVESTIGATION OF ACUTE INFLUENCES.

18424 APTIC NO. 36830

**NISHIKAWA Y**

ON THE ATMOSPHERIC CONCENTRATION OF POLYCYCLIC HYDROCARBONS IN URBAN AREA.

*18255 APTIC NO. 36844

**NISHIMOTO S**

INVESTIGATION OF ACUTE INFLUENCES.

18424 APTIC NO. 36830

**NISHINO S**

THE TREATMENT OF EXHAUST OIL VAPOUR OF HOT FORGING PROCESS.

*18073 APTIC NO. 36471

**NISHIYAMA M**

GAS CHROMATOGRAPHY OF COMBUSTION PRODUCTS.

17914 APTIC NO. 36898

**NIX J**

THE SIMULTANEOUS EXTRACTION OF IRON, MANGANESE, COPPER, COBALT, NICKEL, CHROMIUM, LEAD, AND ZINC FROM NATURAL WATER FOR DETERMINATION BY ATOMIC ABSORPTION SPECTROSCOPY.

*18371 APTIC NO. 36067

**NODA S**

IMPRESSIONS.

*18531 APTIC NO. 36316

**NOMA H**

STUDIES ON THE INDUSTRIAL LEAD POISONING. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN HUMAN BEING THROUGH THE RESPIRATORY TRACT.

18423 APTIC NO. 36129

**NOMA M**

THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.

18267 APTIC NO. 36288

**NOMOTO H**
AN ANALYSIS OF AIR POLLUTION AND METEOROLOGICAL ELEMENTS IN OSAKA.
*18320 APTIC NO. 36307

**NORCO J E**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**NORO L**
THE AIR POLLUTION SITUATION AND SPECIAL PROBLEMS IN FINLAND.
17942 APTIC NO. 36423

**NOSE Y**
AIR POLLUTION CONTROL AND ITS EVALUATION OF THE SEVERAL CITIES IN YAMAGUCHI PREFECTURE.
*18437 APTIC NO. 36809

**NOUSI H**
THE CORRELATION BETWEEN OXIDANTS AND VARIOUS FACTOR.
18313 APTIC NO. 36851

**NOVAK L**
ENVIRONMENTAL CONTAMINATION BY LEAD FROM A MINE AND SMELTER.
18405 APTIC NO. 36283

**NUKADA M**
DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (II) SOME QUESTIONS FOR DETERMINATION OF HYDROCARBONS BY THE HYDROCARBON ANALYZER.
18205 APTIC NO. 36836
DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (I) DECISION AND STABILITY OF STANDARD VALUE OF CALIBRATION GASES.
*18182 APTIC NO. 36839

## O

**OBLAENDER K**
THE ETERNAL AUTOMOBILE EXHAUST PROBLEM.
*18183 APTIC NO. 36095

**ODA K**
METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I).
18317 APTIC NO. 36310

**ODAIRA T**
AIR POLLUTION FORECASTING PROGRAM.
18304 APTIC NO. 36306
EVALUATION OF ODOR POLLUTION.
18167 APTIC NO. 36468
DISCUSSION OF NEUTRAL KI METHOD FOR OXIDANT.
18159 APTIC NO. 36498
STUDIES OF CO PROFILE AROUND THE CROSSROADS.
18259 APTIC NO. 36502
RESEARCH ON REGIONAL REPRESENTABILITY OF SO2 CONCENTRATION.
18228 APTIC NO. 36805
ON HEAVY METALS IN SUSPENDED PARTICULATE AND LOCAL CHARACTERISTICS IN TOKYO.
18251 APTIC NO. 37191
SOME STUDIES ABOUT FORECASTING OF PHOTOCHEMICAL SMOG.
18316 APTIC NO. 37192
DETERMINATION OF PAN IN ATMOSPHERE.
18202 APTIC NO. 37206

**OELS F**
PRESENT STATE OF DEVELOPMENT OF FLUE-GAS DESULPHURIZING INSTALLATIONS IN NORTHRHINE WESTPHALIA.
*18074 APTIC NO. 36389

**OGAWA I**
EXHAUST AMMONIA TREATMENT IN A FERTILIZER PLANT.
18063 APTIC NO. 36475
EXHAUST FLUORIDES FROM GYPSUM PLANTS.
18076 APTIC NO. 37164

**OGAWA R**
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS NO.2 COLLECTION EFFICIENCY OF THIMBLE FILTER.
18148 APTIC NO. 36840
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS. NO. 1 STUDY ON THE IMPURITY METAL IN THIMBLE FILTER.
18184 APTIC NO. 36841

**OGDEN E C**
DISPERSION AND DEPOSITION OF CORN POLLEN FROM EXPERIMENTAL SOURCES.
18329 APTIC NO. 36111

**OHIGASHI S**
HEAT CAPACITY CHANGES PREDICT NITROGEN OXIDES REDUCTION BY EXHAUST GAS RECIRCULATION.
*18075 APTIC NO. 36158

**OHKATA S**
DISCHARGE RATE OF SOLID PARTICLES THROUGH ORIFICE WITH COCURRENT STREAM OF GAS.
18368 APTIC NO. 36223

**OI T**
THE TREATMENT OF EXHAUST OIL VAPOUR OF HOT FORGING PROCESS.
18073 APTIC NO. 36471

**OIKAWA K**
OXIDATION OF SO2 BY PARTICULATES COLLECTED ON FILTERS.
18322 APTIC NO. 36501
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS NO.2 COLLECTION EFFICIENCY OF THIMBLE FILTER.
18148 APTIC NO. 36840
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS. NO. 1 STUDY ON THE IMPURITY METAL IN THIMBLE FILTER.
*18184 APTIC NO. 36841
CONCENTRATION OF VANADIUM IN ATMOSPHERIC PARTICULAR MATTER.
18262 APTIC NO. 36849
THE RELATION OF NO, NO2, AND NO3 IN THE AIR.
18339 APTIC NO. 36855

**OKAMOTO S**
STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (II) - BASED ON METEOROLOGICAL FACTORS.
18324 APTIC NO. 36404
STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (I) TIME SERIES ANALYSIS OF AIR POLLUTANT CONCENTRATION.
*18321 APTIC NO. 36522

**OKITA T**
OXIDATION OF SO2 BY PARTICULATES COLLECTED ON FILTERS.
*18322 APTIC NO. 36501
DETERMINATION OF PAN.
*18185 APTIC NO. 36832
DETERMINATION OF SO2 AND NO3 USING BARRINGER SPECTROMETER.
*18186 APTIC NO. 37158
DETERMINATION OF OZONE USING CHEMILUMESCENCE.
*18187 APTIC NO. 37212

**OKUBO Y**
THE RELATION OF NO, NO2, AND NO3 IN THE AIR.
18339 APTIC NO. 36855

**OKUMURA H**
THE TREATMENT OF EXHAUST OIL VAPOUR OF HOT FORGING PROCESS.
18073 APTIC NO. 36471

**OKUNO T**
ON THE ATMOSPHERIC CONCENTRATION OF POLYCYCLIC HYDROCARBONS IN URBAN AREA.
18255 APTIC NO. 36844
ON THE CONCENTRATION OF AMINE AND ALDENYDE COMPOUNDS FROM FISH-MEAL PLANTS.
18269 APTIC NO. 36850

**OLIN J G**
AUTOMATIC MONITORS OF PARTICULATE MASS EMISSIONS FROM STATIONARY FOSSIL-FUEL COMBUSTION SOURCES.
18199 APTIC NO. 36421

**ONIKUL R I**
THE APPLICATION OF COMPUTATION METHODS IN THE STUDY OF THE LAWS OF FORMATION AND FORECASTING OF RIVER FOGS.
*18323 APTIC NO. 36233

**OODAIRA T**
ANALYSIS OF DRIVING PATTERN IN TOKYO.
17941 APTIC NO. 36505

**OOMICHI S**
DETERMINATION OF SULFURIC ACID AEROSOL IN SUSPENDED PARTICULATE.
*18188 APTIC NO. 36904

THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

VARIATION OF CONCENTRATION BETWEEN SULFUR DIOXIDE AND PARTICLES.
18369 APTIC NO. 37213

**OOTAKI A**
STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (II) - BASED ON METEOROLOGICAL FACTORS.
*18324 APTIC NO. 36494

STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (I) TIME SERIES ANALYSIS OF AIR POLLUTANT CONCENTRATION.
18321 APTIC NO. 36522

**OOTE S**
EXHAUST AMMONIA TREATMENT IN A FERTILIZER PLANT.
18063 APTIC NO. 36475

EXHAUST FLUORIDES FROM GYPSUM PLANTS.
*18076 APTIC NO. 37164

**ORDIN L**
INHIBITORY PRODUCTS OF THE ACTION OF PEROXYACETYL NITRATE UPON INDOLE-3-ACETIC ACID.
18458 APTIC NO. 36194

**OSAWA S**
THE CORRELATION BETWEEN OXIDANTS AND VARIOUS FACTOR.
18313 APTIC NO. 36851

**OTA H**
RELATION BETWEEN AIR POLLUTION AND DIURNAL RANGE OF AIR TEMPERATURE IN ICHIARA DISTRICT.
18351 APTIC NO. 36289

**OUWERKERK C**
THE SEPARATIVE POWER OF SHORT COUNTERCURRENT CENTRIFUGES.
*18372 APTIC NO. 36319

**OYA M**
PREVENTION OF DISCHARGING NOX FROM COMBUSTION FURNACE.
*17957 APTIC NO. 36296

**OYA T**
ON THE ENVIRONMENTAL CONDITIONS OF THE SURVEY POINT HEAVILY CONTAMINATED BY THE AUTOMOTIVE EXHAUST GAS.
18235 APTIC NO. 37165

**OZAKI T**
EGR AS COUNTERMEASURE TO NOX IN DIESEL ENGINE.
18104 APTIC NO. 37182

P

**PANTALEONI R**
AN APPROACH TO ODOR CONTROL.
*18077 APTIC NO. 36271

**PASON A**
DIURNAL CHANGES OF THE SULFUR DIOXIDE CONCENTRATIONS IN THE UNIVERSITY DISTRICT OF GLIWICE DURING THE SPRINGTIME.
*18256 APTIC NO. 36281

**PATTERSON C C**
THE OCCURRENCE AND SIGNIFICANCE OF LEAD ISOTOPES IN PELAGIC SEDIMENTS.
18356 APTIC NO. 36103

**PELL M**
REACTION OF HYDROGEN SULFIDE WITH FULLY CALCINED DOLOMITE.
*18078 APTIC NO. 36248

**PEMBROOK J D**
ABSORPTION AND EMISSION BY SO2 BETWEEN 1050 and 1400/CM (9.5-7.1 MICRON). (FINAL TECHNICAL REPORT).
18129 APTIC NO. 36185

**PERKINS R W**
COSMOGENIC RADIONUCLIDE TRACERS OF IN-CLOUD SCAVENGING PROCESSES.
*18325 APTIC NO. 36442

**PETERS J M**
CHRONIC NONSPECIFIC RESPIRATORY DISEASE. BERLIN, N.H., 1961-1967 - A PROSPECTIVE STUDY.
18410 APTIC NO. 36217

**PETRIW A**
DIRECTIONAL ION ANEMOMETER.
*18326 APTIC NO. 36134

**PIGFORD R L**
RATE OF REACTION OF GASEOUS NITROGEN OXIDES WITH WATER.
18358 APTIC NO. 36077

**PINKERTON J D**
THE INFLUENCE OF TURBULENCE AND COMPOUNDING ON UNBURNED HYDROCARBONS AND NITRIC OXIDE IN THE COMBUSTION PRODUCTS FROM INTERNAL COMBUSTION ENGINES.
*18079 APTIC NO. 36450

**PITTS J N JR**
SINGLET OXYGEN IN THE ENVIRONMENTAL SCIENCES. EVIDENCE FOR THE PRODUCTION OF 02 (1 DELTA G) BY ENERGY TRANSFER IN THE GAS PHASE.
18377 APTIC NO. 36402

**PLANK R**
THE PROGRESS AND EFFECTS OF SMOKE CONTROL IN LONDON.
*18521 APTIC NO. 36448

**PLESS L G**
SOME EFFECTS OF EXPERIMENTAL VEHICLE EMISSION CONTROL SYSTEMS ON ENGINE DEPOSITS AND WEAR.
*17958 APTIC NO. 36083

**POOLER F JR**
ATMOSPHERIC TRANSPORT AND DISPERSION OF PESTICIDES.
*18327 APTIC NO. 36246

**POSKITT R W**
CARS AND THE NEW GASOLINES 1971.
17953 APTIC NO. 36884

**PRADEL J**
USE OF FUMIGENS FOR THE STUDY OF VENTILATION. RECYCLING EVALUATION, MEASUREMENT OF TRANSIT TIME.
18128 APTIC NO. 36445

**PRINZ B**
TERMINOLOGY IN THE FIELD OF AIR TESTING.
*18522 APTIC NO. 36262

**PRZYBYLSKI Z**
RESULTS OF CONSECUTIVE OBSERVATION OF EFFECT OF SO2, SO3 and H2SO4 GASES AND VAPORS ON TREES, SHRUBS, AND ENTOMOFAUNA OF ORCHARDS IN THE VICINITY OF SULFUR MINES AND SULFUR PROCESSING PLANT IN MACHOW.
*18468 APTIC NO. 36218

**PURDUE L J**
A RAPID SENSITIVE METHOD FOR THE CALIBRATION OF PERMEATION DEVICES.
*18189 APTIC NO. 36133

**PYCK J**
DRY PURIFICATION OF INCINERATOR OFF-GASES.
18012 APTIC NO. 36174

R

**RAO D N**
FLUORIDE INJURY SYMPTOMS IN EPIPHYTIC LICHENS AND MOSSES.
18461 APTIC NO. 36883

**RASTORGUYEVA G P**
HEAT BALANCE STUDIES OF THE ACTIVE SURFACE IN THE AREA OF A MOLDAVIAN HYDROELECTRIC PLANT.
*18328 APTIC NO. 36443

**RAWA R T**
SO2 CONTROL FOR SMALL BOILERS.
*18080 APTIC NO. 36885

**RAYNOR G S**
DISPERSION AND DEPOSITION OF CORN POLLEN FROM EXPERIMENTAL SOURCES.
*18329 APTIC NO. 36111

**RECHT P**
SANITARY PROTECTION OF THE ENVIRONMENT IN THE INDUSTRIALIZED COUNTRIES.
*17959 APTIC NO. 36477

**REDERS K**
ROAD ANTIKNOCK PERFORMANCE OF LOW LEAD AND NONLEADED GASOLINES IN EUROPEAN CARS.
17917 APTIC NO. 36082

**REILAND W H**
EFFECT OF UNLEADED FUEL ON LUBRICANT PERFORMANCE.
17923 APTIC NO. 36080

**REIST P C**
OPTICAL PROPERTIES OF SODIUM AEROSOLS.
*18373 APTIC NO. 36537

**REPPHUN W F**
GENERAL MOTORS MOBILE EMISSION LABORATORY.
*18190 APTIC NO. 36066

**REVERBERI A**
INSTALLATION FOR THE WASHING OF INDUSTRIAL GASES. NOTE I INFLUENCE OF THE TYPE OF PACKING SURFACE ON THE FLOW DYNAMICS OF THE ABSORBER.
18018 APTIC NO. 36526

**RICHARDSON H L**
AN ELECTROSTATIC SEPARATOR.
*18081 APTIC NO. 36299

**RICHTERS V**
WALL-FREE (L-PHASE VARIANTS OR MYCOPLASMA) ORGANISMS IN THE GUINEA PIG BRONCHUS: ASSOCIATION WITH MICROVILLI OF CILIATED CELLS.
18440 APTIC NO. 36198
THE SPONTANEOUS OCCURRENCE OF WALL-FREE ORGANISMS IN THE GUINEA PIG LUNG; ASSOCIATION WITH MICROVILLI AND CILIA.
18441 APTIC NO. 36200

**RIECK H G JR**
COSMOGENIC RADIONUCLIDE TRACERS OF IN-CLOUD SCAVENGING PROCESSES.
18325 APTIC NO. 36442

**RIGDON L P**
AN EXPERIMENTAL SYSTEM FOR DETERMINING NITROGEN OXIDES IN AIR.
*18191 APTIC NO. 36203

**RISEBROUGH R W**
PESTICIDES: TRANSLALANTIC MOVEMENTS IN THE NORTHEAST TRADES.
*18330 APTIC NO. 36351

**RIZAEV N U**
THE STUDY OF PURIFICATION OF FLUE GASES FROM NITROGEN OXIDES BY KARATAU PHOSPHATE.
18068 APTIC NO. 36257

**ROBERTS J J**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**ROBISON E B**
SOOT EMISSION FROM RESIDENTIAL DISTILLATE OIL BURNERS IN MARYLAND.
*18257 APTIC NO. 36193

**RODGERS**
FURTHER STUDIES ON THE ELECTRO-AERODYNAMIC PRECIPITATOR.
18094 APTIC NO. 36287

**ROGERS J D JR**
CARS AND THE NEW GASOLINES 1971.
17953 APTIC NO. 36084

**ROSEN C G A**
FUTURE POWERPLANTS TO COMBAT AIR POLLUTION.
*17960 APTIC NO. 36121

**ROSENBERG N J**
AIR POLLUTION EFFECTS ON WEATHER AND CLIMATE.
*18331 APTIC NO. 36085

**ROSINSKI J**
PARTICLE DEPOSITION ON AND REENTRAINMENT FROM CONIFEROUS TREES. PART I: EXPERIMENTS WITH TREES.
*18469 APTIC NO. 36374

**ROSS L W**
SIMULATION OF AIR AND WATER POLLUTION DYNAMICS: A SURVEY.
*18332 APTIC NO. 36434

**ROSSENBECK M**
FUEL AND THE PROTECTION OF THE ENVIRONMENT, PART I.
*17961 APTIC NO. 36527

**ROSSIN A D**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**ROUMSEY B**
A NEW DUST COLLECTOR USING ELECTROSTATICALLY SPRAYED WATER.
18017 APTIC NO. 36395

**ROUSSEL A A**
CONTINENTAL REPORT: EUROPE.
*17962 APTIC NO. 36379

**ROZHNYATOVSKIY I I**
FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL.
18477 APTIC NO. 36804

**RUCKELSHAUS W D**
ENVIRONMENTAL PROTECTION AGENCY. MOTOR VEHICLE POLLUTION CONTROL. CALIFORNIA STATE STANDARDS. NOTICE OF PUBLIC HEARING.
*18488 APTIC NO. 36519

**RYS YEV O A**
USE OF COSMOGENIC RADIOISOTOPE MIGRATION PATTERNS IN THE STUDY OF THE PROPAGATION OF RADIOACTIVE CONTAMINATION IN THE ATMOSPHERE. 1967 (?).
18294 APTIC NO. 36062

S

**SACHDEV S L**
SPECIFIC METHOD FOR THE DETERMINATION OF ZONE IN THE ATMOSPHERE.
*18192 APTIC NO. 36887

**SACHSE J**
AN EFFICIENT METHOD AND TYPE OF DEVICE FOR MEASURING, AND A PROPOSAL FOR INTERNATIONALLY ACCEPTABLE LIMITS OF DIESEL SMOKE.
18153 APTIC NO. 36438

**SAIJO T**
ODOR POLLUTION OF KASHIMA DISTRICT.
*18258 APTIC NO. 36845

**SAIKI Y**
VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR.
18318 APTIC NO. 36487
STUDIES ON AUTO-EXHAUST GAS POLLUTION IN KANAGAWA PREFECTURE.
18253 APTIC NO. 36504
METEOROLOGICAL STUDIES ON THE AIR POLLUTION AT KEIHIN INDUSTRIAL REGION IN WINTER.
18348 APTIC NO. 36807

**SAITO K**
ON THE TWO-DIMENSIONAL DISTRIBUTION DIAGRAMS OF WIND-VELOCITY AND AIR POLLUTION.
18350 APTIC NO. 36493

**SAITO T**
GAS TURBINE COMBUSTORS.
17972 APTIC NO. 36268
ANALYSIS OF DRIVING PATTERN IN TOKYO.
17941 APTIC NO. 36505
THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

**SAKAGAMI J**
ON THE DIFFUSION WHEN THE LAYER FLUX-ZERO IS ABOVE THE SOURCE.
*18333 APTIC NO. 36488

**SAKAI K**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
18272 APTIC NO. 36293

**SAKANAKA G**
PREVENTION OF ACID RESIDUE FORMATION IN OIL-BURNING POWER STATION BY THE ADDITION OF AMMONIA.
18085 APTIC NO. 36415

**SAKURABA S**
DIFFUSION EXPERIMENT OVER AN URBAN AREA.
18335 APTIC NO. 36490

**SAKURAI T**
AIR POLLUTION FORECASTING PROGRAM.
18304 APTIC NO. 36308

**SALEEM A**
DESULPHURIZATION OF COAL.
*18082 APTIC NO. 37160

**SALVI G**
UTILIZATION OF SODIUM ALUMINATES FOR THE ABSORPTION OF SULFUROUS DIOXIDE FROM FLUE GASES.
*18083 APTIC NO. 36853

**SAMOYLOV V I**
ON THE CALCULATION OF EQUILIBRIUM SULFUR YIELDS IN SULFUR PRODUCTION FROM GASES OF WATER-JACKET FURNACES IN CLOSED SMELTING PROCESS.
18098 APTIC NO. 36186

**SANDA V**
CONSIDERATIONS ON THE EFFECTS OF ATMOSPHERE IMPURIFICATION UPON THE FLORA AND VEGETATION OF THE COPSA MICA REGION.
18459 APTIC NO. 36803

**SANDAGE C**
TOLERANCE CRITERIA FOR CONTINUOUS INHALATION EXPOSURE TO TOXIC MATERIAL. II. EFFECTS ON ANIMALS OF 90-DAY EXPOSURE TO H2S, METHYL MERCAPTAN, INDOLE, AND A MIXTURE OF H2S, METHYL MERCAPTAN, INDOLE, AND SKATOLE.
*18438 APTIC NO. 36072

**SANO H**
COMPARISON BETWEEN VARIOUS DESULFURIZATION METHODS (2). COMPARISON BETWEEN DESULFURIZATION METHODS OF STACK GAS.
*18084 APTIC NO. 36295

**SANO I**
PRODUCTION OF AEROSOLS.
*18334 APTIC NO. 36038

**SANO U**
CONTROL OF SULFUR OXIDES IN TOKYO.
*18523 APTIC NO. 37163

**SARUTA K**
TRACE METALS IN SUSPENDED PARTICULATES.
18252 APTIC NO. 36486

**SASABE Y**
PREVENTION OF ACID RESIDUE FORMATION IN OIL-BURNING POWER STATION BY THE ADDITION OF AMMONIA.
*18085 APTIC NO. 36415

**SATO A**
INVESTIGATION ON THE AIR POLLUTION IN MIYAKO DISTRICT.
18264 APTIC NO. 36806

**SATO J**
DIFFUSION EXPERIMENT OVER AN URBAN AREA.
*18335 APTIC NO. 36490

**SATO K**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

**SATO S**
STUDY OF THE INFLUENCE OF SO2 ON NO2 MEASUREMENTS.
*18193 APTIC NO. 36859

**SATO Y**
THE CORRELATION BETWEEN OXIDANTS AND VARIOUS FACTOR.
18313 APTIC NO. 36851

**SAWICKI C R**
COLORIMETRIC DETERMINATION OF NITRATE FOLLOWING HYDRAZINE REDUCTION TO NITRITE.
*18194 APTIC NO. 36191

**SCARINGELLI F P**
COLORIMETRIC DETERMINATION OF NITRATE FOLLOWING HYDRAZINE REDUCTION TO NITRITE.
18194 APTIC NO. 36191

**SCHEFFER J R**
SINGLET OXYGEN REACTIONS FROM PHOTOPEROXIDES.
18380 APTIC NO. 36325

**SCHENCK N C**
INCIDENCE OF AIRBORNE FUNGUS SPORES OVER WATERMELON FIELDS IN FLORIDA.
*18470 APTIC NO. 36139

**SCHERBAK M P**
A COLORIMETRIC METHOD FOR THE DETERMINATION OF TOTAL OXIDES OF NITROGEN IN CIGARETTE SMOKE.
ERROR

**SCHLUETER A**
NON-POLLUTING POWER PRODUCTION BY NUCLEAR FUSION.
*17963 APTIC NO. 37187

**SCHMIDT E**
THE FORMATION AND EMISSION OF AIR POLLUTING SUBSTANCES BY BRICK KILNS.
ERROR

**SCHMIDT F**
THE CAUSE FOR CANCER: EXHAUST GAS OR CIGARETTE SMOKE.
*18439 APTIC NO. 36538

**SCHNEIDER A**
NEW POWER PLANT UNIT FOR CHEMICAL PLANT.
*18086 APTIC NO. 37185

**SCHOENTHALER E P**
AIR SCREEN APPARATUS WITH FILTER REMOVAL MEANS.
*18087 APTIC NO. 36919

**SCHOPMAN J**
TRANSLATIONAL SPECTROSCOPY OF THE UNIMOLECULAR DISSOCIATION NO+ YIELDS 0+ PLUS N.
18361 APTIC NO. 36036

**SCHULZE F**
METHOD AND APPARATUS FOR ANALYSIS OF GASES FOR SULFUR DIOXIDE.
*18196 APTIC NO. 36865

**SCHWARTZ C W**
FORD MOTOR COMPANY S MOBILE EMISSIONS TEST LABORATORY.
*18197 APTIC NO. 36052

**SCHWARZ K**
DUST EMISSIONS FROM COAL-FIRED BOILERS IN THE FEDERAL REPUBLIC OF GERMANY.
*17965 APTIC NO. 36419

**SCHWARZENBEK E F**
CATALYTIC REFORMING.
*18088 APTIC NO. 37173

**SCIARAFFA P L**
AUTOMOBILE EXHAUST ANALYSIS FOR LEAD USING A NUCLEAR TECHNIQUE.
*18198 APTIC NO. 37175

**SEDUNOV JU S**
ON THE GROWTH OF DROPLETS BY CONDENSATION ON HYGROSCOPIC NUCLEI.
18278 APTIC NO. 36142

**SEGAWA T**
AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.
18499 APTIC NO. 36306

**SEKI K**
METEOROLOGICAL ELEMENT AND CONTAMINATIVE ELEMENT ABOUT SEASONAL APPEARANCE OF OXIDANT.
*18336 APTIC NO. 36304
METEOROLOGICAL ELEMENT AND TOPOGRAPHICAL ELEMENT ABOUT LOCAL APPEARANCE OF OXIDANT.
*18337 APTIC NO. 36305
CHARACTERISTIC OF PRESSURE PATTERN ABOUT APPEARANCE OF OXIDANT.
*18338 APTIC NO. 36311

**SEKIGUCHI Y**
VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR.
18318 APTIC NO. 36487
STUDIES ON AUTO-EXHAUST GAS POLLUTION IN KANAGAWA PREFECTURE.
18253 APTIC NO. 36504

**SEM G J**
AUTOMATIC MONITORS OF PARTICULATE MASS EMISSIONS FROM STATIONARY FOSSIL-FUEL COMBUSTION SOURCES.
*18199 APTIC NO. 36421

**SEQUEIRA R**
ENVIRONMENTAL CONCENTRATIONS OF SOME OF THE MAJOR INORGANIC POLLUTANTS AT THE BARC SITE, TROMBAY, BOMBAY.
18274 APTIC NO. 36168

**SEQUERIA R**
AIR POLLUTION STUDIES IN TROMBAY REGION.
18275 APTIC NO. 36237

**SERGEYEV A P**
FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL.
18477 APTIC NO. 36804

**SHADDICK C W**
ATMOSPHERIC POLLUTION AND MORTALITY IN THE COUNTY OF LONDON.
18419 APTIC NO. 36361

**SHAFNER H**
CHEMICAL MUTAGENS IN THE HUMAN ENVIRONMENT.
18408 APTIC NO. 36327

**SHAH I S**
WET APPROACH VENTURI SCRUBBER.
*18089 APTIC NO. 36870

**SHALNOVA K G**
CATALYTIC REDUCTION OF TERTRAPHENYL LEAD WITH BIS-ALLYL PALLADIUM CHLORIDE.
18359 APTIC NO. 36524

**SHANNON L J**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
17976 APTIC NO. 36343

**SHAPIRO E G**
A FIELD INSTRUMENT FOR DETECTING AIRBORNE HALOGEN COMPOUNDS.
18181 APTIC NO. 36888

**SHAPIRO I M**
LEAD LEVELS IN DECIDUOUS TEETH OF URBAN AND SUBURBAN AMERICAN CHILDREN.
18436 APTIC NO. 36534

**SHAW M**
PLUG-IN SENSORS FOR AIR POLLUTION MONITORING.
*18200 APTIC NO. 36061

**SHCHERBINA E I**
POTENTIOMETRIC DETERMINATIONS OF THE GROUP COMPOSITION OF SULFUR COMPOUNDS PRESENT IN STRAIGHT-RUN GASOLINE FRACTIONS.
*17966 APTIC NO. 36533

**SHEAR M J**
PRODUCTION OF SUBCUTANEOUS SARCOMAS IN MICE WITH TARS EXTRACTED FROM ATMOSPHERIC DUSTS.
18432 APTIC NO. 36459

**SHERRY D E**
AN OZONE JOURNAL.
18413 APTIC NO. 36370

**SHERWIN R P**
WALL-FREE (L-PHASE VARIANTS OR MYCOPLASMA) ORGANISMS IN THE GUINEA PIG BRONCHUS: ASSOCIATION WITH MICROVILLI OF CILIATED CELLS.
*18440 APTIC NO. 36198

THE SPONTANEOUS OCCURRENCE OF WALL-FREE ORGANISMS IN THE GUINEA PIG LUNG; ASSOCIATION WITH MICROVILLI AND CILIA.
*18441 APTIC NO. 36200

**SHIBAHARA T**
AIR CLEANER FILTERS.
*18090 APTIC NO. 37209

**SHIBATA S**
INVESTIGATION OF AIR POLLUTION IN SOUTHERN AREA OF NAGOYA.
18273 APTIC NO. 37186

**SHIBUYA K**
THE RELATION OF NO, NO2, AND NO3 IN THE AIR.
*18339 APTIC NO. 36855

**SHIGETA Y**
OBSERVATION ON THE BASIC INVESTIGATION METHOD FOR BAD ODOR FROM THE STANDPOINT OF ON-SITE TESTS. (A SEQUEL).
18150 APTIC NO. 36894

AN EXAMPLE OF INVESTIGATION METHODS FOR ODOR POLLUTION.
18244 APTIC NO. 36910

**SHIMA H**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**SHIMIZU T**
INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**SHIMIZU Y**
THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**SHIMKIN M B**
PRODUCTION OF SUBCUTANEOUS SARCOMAS IN MICE WITH TARS EXTRACTED FROM ATMOSPHERIC DUSTS.
18432 APTIC NO. 36459

**SHINRA K**
THE ESTIMATION OF DIFFUSION FROM THE AREA-SOURCES.
*18340 APTIC NO. 36496

**SHIOZAWA K**
STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (II) - BASED ON METEOROLOGICAL FACTORS.
18324 APTIC NO. 36494

STUDIES ON THE PREDICTION OF AIR POLLUTANT CONCENTRATION (I) TIME SERIES ANALYSIS OF AIR POLLUTANT CONCENTRATION.
18321 APTIC NO. 36522

**SHIRAI T**
DISCHARGE RATE OF SOLID PARTICLES THROUGH ORIFICE WITH COCURRENT STREAM OF GAS.
18368 APTIC NO. 36223

**SHIRAKAWA H**
ON THE ENVIRONMENTAL CONDITIONS OF THE SURVEY POINT HEAVILY CONTAMINATED BY THE AUTOMOTIVE EXHAUST GAS.
18235 APTIC NO. 37165

**SHIRASAWA T**
DUST CONTROL TECHNIQUE.
*18201 APTIC NO. 36878

**SHOJI H**
OBSERVING THE POLLUTION PROBLEMS OF WESTERN NATIONS.
*18524 APTIC NO. 36318

**SHULTS W D**
OAK RIDGE AIR QUALITY INDEX.
18209 APTIC NO. 36179

**SIEWERT R M**
HOW INDIVIDUAL VALVE TIMING EVENTS AFFECT EXHAUST EMISSIONS.
*17967 APTIC NO. 36120

**SILVERMAN L**
HANDBOOK ON AIR CLEANING PARTICULATE REMOVAL.
18020 APTIC NO. 36184

**SIMPSON C L**
USE OF METEOROLOGICAL MEASUREMENTS FOR PREDICTING DISPERSION FROM RELEASES NEAR GROUND LEVEL.
18293 APTIC NO. 36176

**SIMURA O**
TREATMENT OF HYDROGEN SULFIDE GAS AT TAGONOURA HARBOR.
*18091 APTIC NO. 37200

**SISSON W**
ESTIMATING FLY ASH EMISSIONS.
*18092 APTIC NO. 36884

**SKUBENICH V V**
EXCITATION CROSS-SECTIONS OF CARBON MONOXIDE LEVELS WITH ELECTRON COLLISIONS.
*18374 APTIC NO. 36323

**SMITH J R**
REDESIGN OF EXISTING CATALYTIC REFORMING UNITS FOR OCTANE IMPROVEMENTS.
18002 APTIC NO. 36453

**SMITH M C**
PROBLEMS OF CONVERSION TO LOW-SULFUR RESIDUAL FUEL OIL.
*18093 APTIC NO. 36321

**SMITH T A**
A COLORIMETRIC METHOD FOR THE DETERMINATION OF TOTAL OXIDES OF NITROGEN IN CIGARETTE SMOKE.
ERROR

**SOEJIMA S**
IMPRESSIONS.
*17968 APTIC NO. 36335

**SOFUKU M**
STUDIES OF CO PROFILE AROUND THE CROSSROADS.
*18259 APTIC NO. 36502

DETERMINATION OF PAN.
18185 APTIC NO. 36832

DETERMINATION OF PAN IN ATMOSPHERE.
*18202 APTIC NO. 37206

**SOGA H**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

**SOLOMATINA I I**
HEAT BALANCE STUDIES OF THE ACTIVE SURFACE IN THE AREA OF A MOLDAVIAN HYDROELECTRIC PLANT.
18328 APTIC NO. 36443

**SOO S L**
SEDIMENTARY PIPE FLOW.
*18375 APTIC NO. 3615

CORE VELOCITY DISTRIBUTION IN SWIRLING PIPE FLOW.
*18376 APTIC NO. 36177

FURTHER STUDIES ON THE ELECTRO-AERODYNAMIC PRECIPITATOR.
*18094 APTIC NO. 36287

**SORENSEN G C**

EXTERNAL COMBUSTION ENGINE.
*17969 APTIC NO. 36868

**SPEDDING D J**

UPTAKE OF SULPHUR DIOXIDE BY BARLEY LEAVES AT LOW SULPHUR DIOXIDE CONCENTRATIONS.
*18471 APTIC NO. 36153

**SPRUNG J L**

SINGLET OXYGEN IN THE ENVIRONMENTAL SCIENCES. EVIDENCE FOR THE PRODUCTION OF 02 (1 DELTA G) BY ENERGY TRANSFER IN THE GAS PHASE.
18377 APTIC NO. 36402

**SPURNY K**

IMPROVEMENTS ON OR RELATING TO COMPOSITE FILTERS.
*18095 APTIC NO. 36056

**STANLEY R L**

ORIGIN OF LEAD IN SURFACE VEGETATION.
18462 APTIC NO. 36197

SPUTUM HISTAMINE AND INHALATION TOXICITY. (FINAL REPORT).
18445 APTIC NO. 36199

**STEBAR R F**

EFFECTS OF CHARGE DILUTION OF NITRIC OXIDE EMISSION FROM A SINGLE-CYCLINDER ENGINE.
17999 APTIC NO. 36146

**STEER R P**

SINGLET OXYGEN IN THE ENVIRONMENTAL SCIENCES. EVIDENCE FOR THE PRODUCTION OF 02 (1 DELTA G) BY ENERGY TRANSFER IN THE GAS PHASE.
*18377 APTIC NO. 36402

**STEHLE R J**

MERCURY-LADEN AIR: THE TOXIC CONCENTRATION, THE PROPORTION ABSORBED, AND THE URINARY EXCRETION.
18414 APTIC NO. 36228

**STEPHANY H**

CONTINENTAL REPORT: EUROPE.
17962 APTIC NO. 36379

**STEPHENS J W**

REDESIGN OF EXISTING CATALYTIC REFORMING UNITS FOR OCTANE IMPROVEMENTS.
18002 APTIC NO. 36453

**STEREKHOVA N P**

SOME INDICES OF LIPID METABOLISM IN THE BLOOD OF WORKERS ENGAGED IN COPPER WORKS.
18388 APTIC NO. 36517

**STEUERNAGEL W**

CLEANING DEVICE FOR ELECTROSTATIC DUST COLLECTOR DISCHARGE ELECTRODES.
*18096 APTIC NO. 36893

**STEVENS R K**

A STABLE OZONE SOURCE APPLICABLE AS A SECONDARY STANDARD FOR CALIBRATION OF ATMOSPHERIC MONITORS.
18363 APTIC NO. 36107

**STEWART N G**

USE OF LONG-LIVED NATURAL RADIOACTIVITY AS AN ATMOSPHERIC TRACER.
18282 APTIC NO. 36252

**STICKNEY P B**

AIR POLLUTION COSTS AS THEY RELATE TO THE RUBBER INDUSTRY.
*18476 APTIC NO. 36108

**STIVENDER D L**

DEVELOPMENT OF A FUEL-BASED MASS EMISSION MEASUREMENT PROCEDURE.
*18203 APTIC NO. 36050

**STOCKMAN ROBERT L**

AIR POLLUTION CONTROL IN WASHINGTON – PROSPECTS AND NEEDS.
*18525 APTIC NO. 36390

**STOCKS P**

LUNG CANCER AND BRONCHITIS IN RELATION TO CIGARETTE SMOKING AND FUEL CONSUMPTION IN TWENTY COUNTRIES.
*18442 APTIC NO. 36425

**STODDARD C**

THE REMOVAL OF CARBONYL SULPHIDE FROM INDUSTRIAL GASES.
18001 APTIC NO. 37203

**STOEFEN D**

AGAIN: THE FUTURE FUEL FOR AUTOMOBILES.
*17970 APTIC NO. 36541

**STOKELD R W**

ALKYLATIN AND ISOMERIZATION.
17943 APTIC NO. 36535

**STOKES R**

EXHAUST GAS PURIFIER.
*18097 APTIC NO. 36188

**STOKINGER H E**

PROTECTION BY SULFUR COMPOUNDS AGAINST THE AIR POLLUTANTS OZONE AND NITROGEN DIOXIDE.
18409 APTIC NO. 36224

**STRATMANN H**

TERMINOLOGY IN THE FIELD OF AIR TESTING.
18522 APTIC NO. 36262

RESULTS OF SULPHUR DIOXIDE MEASUREMENTS WITHIN THE AIR MONITORING PROGRAMME OF NORTH RHINE WESTPHALIA.
18232 APTIC NO. 36380

DUST FALL MEASUREMENTS IN THE STATE OF NORDRHEIN-WESTFALEN FROM OCTOBER 1, 1967 TILL SEPTEMBER 30 1968.
*18260 APTIC NO. 36408

SMOG ALARM SERVICE IN NORDRHEIN-WESTFALEN FROM OCTOBER 30, 1967 TILL OCTOBER 27, 1968.
*18261 APTIC NO. 36414

**STREZHNEV I V**

ON THE CALCULATION OF EQUILIBRIUM SULFUR YIELDS IN SULFUR PRODUCTION FROM GASES OF WATER-JACKET FURNACES IN CLOSED SMELTING PROCESS.
*18098 APTIC NO. 36186

**STUART B O**

STUDIES OF INHALED RADON DAUGHTERS, URANIUM ORE DUST, DIESEL EXHAUST, AND CIGARETTE SMOKE IN DOGS AND HAMSTERS.
*18443 APTIC NO. 36454

**SUGAWARA S**

INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**SUGIHARA K**

HEAT CAPACITY CHANGES PREDICT NITROGEN OXIDES REDUCTION BY EXHAUST GAS RECIRCULATION.
18075 APTIC NO. 36158

**SUGIMAE A**

TRACE METALS IN SUSPENDED PARTICULATES (VII).
18242 APTIC NO. 36499

**SUGIMOTO T**

A SURVEY ON MN PARTICULATE POLLUTION AND ENVIRONMENTAL IMPROVEMENTS.
18245 APTIC NO. 36531

**SULLIVAN J L**

CONTINENTAL REPORT: AUSTRALASIA.
*17971 APTIC NO. 36378

**SUNDARAM M**

A STUDY OF DESULPHURIZATION OXIDE.
*18099 APTIC NO. 36059

**SUPLINKAS R J**

AIR POLLUTION MEASUREMENTS IN THE FRESHMAN LABORATORY.
*18204 APTIC NO. 36890

**SUSLOVA V V**

EFFECT OF SULFUR DIOXIDE ON PIGMENTS OF FORAGE GRASS.
18467 APTIC NO. 36166

**SUTUGIN A G**

COAGULATION CONSTANTS OF AEROSOLS AT KNUDSEN NUMBERS OF THE ORDER OF 1.0.
*18378 APTIC NO. 36320

FORMATION OF CONDENSATION AEROSOLS UNDER RAPIDLY CHANGING ENVIRONMENTAL CONDITIONS. NON-COAGULATED, HIGH-DISPERSED AEROSOLS.
*18341 APTIC NO. 36039

**SUZUKA T**
THE ESTIMATION OF AUTOMOBILE EXHAUST EMISSIONS IN OSAKA.
17933 APTIC NO. 36290

**SUZUKI A**
DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (II) SOME QUESTIONS FOR DETERMINATION OF HYDROCARBONS BY THE HYDROCARBON ANALYZER.
*18205 APTIC NO. 36836
DISCUSSION OF A FEW POINTS ABOUT CALIBRATION GASES FOR DETERMINATION OF AIR POLLUTION (I) DECISION AND STABILITY OF STANDARD VALUE OF CALIBRATION GASES.
18182 APTIC NO. 36839

**SUZUKI F**
ON THE DIFFUSION WHEN THE LAYER FLUX-ZERO IS ABOVE THE SOURCE.
18333 APTIC NO. 36488

**SUZUKI H**
CONCENTRATION OF VANADIUM IN ATMOSPHERIC PARTICULAR MATTER.
*18262 APTIC NO. 36849
ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
18303 APTIC NO. 37198

**SUZUKI K**
GAS TURBINE COMBUSTORS.
*17972 APTIC NO. 36268
IMPRESSIONS.
*17973 APTIC NO. 36331

**SUZUKI M**
THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

**SUZUKI S**
PHOTOCHEMICAL REACTION BETWEEN SO2 AND ORGANIC COMPOUND (III).
18301 APTIC NO. 36483

**SUZUKI T**
AIR POLLUTION CAUSED BY EXHAUST GAS OF AUTOMOBILES IN SHIZUOKA PREFECTURE.
18270 APTIC NO. 36909

**SWARTZ H**
TOBACCO SMOKE: A NOXIOUS AIR POLLUTANT. A REVIEW (AND COMMENT). PART I.
*18444 APTIC NO. 36278

**SYNORADZKI Z**
THE EVALUATION OF CONCENTRATION PROFILES OF GASEOUS AIR POLLUTANTS IN THE GROUND LAYER, IN THE VICINITY OF A POINT SOURCE OF EMISSION.
*18342 APTIC NO. 36282

**SZEKESSY M**
AIRBORNE FUNGUS SPORES IN BOGOTA, COLOMBIA: A FIVE YEAR STUDY.
18240 APTIC NO. 36229

## T

**TABERSHAW I R**
BIOLOGIC EFFECTS OF NITROGEN DIOXIDE IN RELATION TO AIR QUALITY STANDARDS.
18402 APTIC NO. 36362

**TADA O**
ON THE AIR POLLUTION IN SUBTERRANEAN PARKING PLACE.
*18263 APTIC NO. 36503

**TAGAWA H**
PREDICTION OF AIR POLLUTION POTENTIAL IN KYOTO.
18315 APTIC NO. 36495

**TAIJUN Y**
EGR AS COUNTERMEASURE TO NOX IN DIESEL ENGINE.
18104 APTIC NO. 37182

**TAIRAFUNE K**
INVESTIGATION ON THE AIR POLLUTION IN MIYAKO DISTRICT.
*18264 APTIC NO. 36806

**TAJAR J G**
THE PERMEATION OF CARBON DIOXIDE, OXYGEN, AND NITROGEN THROUGH WEAKLY BASIC POLYMER MEMBRANES.
*18100 APTIC NO. 36889

**TAJIRI T**
STUDY ON EVALUATION CHOICE SAMPLING OF AIRBORNE DUST.
18216 APTIC NO. 36837

**TAKADA N**
ON THE CONCENTRATION OF AMINE AND ALDENYDE COMPOUNDS FROM FISH-MEAL PLANTS.
18269 APTIC NO. 36850

**TAKAGI S**
STUDIES ON THE ERRORS OF SULFUR DIOXIDE DETERMINATION IN THE ATMOSPHERE BY WEST-GAEKE METHOD.
*18206 APTIC NO. 36097

**TAKAHASHI M**
INVESTIGATION ON THE AIR POLLUTION IN MIYAKO DISTRICT.
18264 APTIC NO. 36806

**TAKAHASHI T**
AIR POLLUTION OF HITACHI DISTRICT (REPORT 2).
18287 APTIC NO. 36810
ODOR POLLUTION OF KASHIMA DISTRICT.
18258 APTIC NO. 36845

**TAKAMATSU K**
VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR.
18318 APTIC NO. 36487
STUDIES ON AUTO-EXHAUST GAS POLLUTION IN KANAGAWA PREFECTURE.
18253 APTIC NO. 36504

**TAKAMATSU T**
MATHEMATICAL MODEL FOR PREDICTION OF CARBON MONOXIDE CONCENTRATION BY AUTOMOBILE EXHAUST GAS.
18314 APTIC NO. 36291

**TAKASE A**
ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
18303 APTIC NO. 37198

**TAKENO T**
COMBUSTION DRIVEN OSCILLATION.
*17974 APTIC NO. 36275

**TAKEO K**
IMPRESSIONS.
*18532 APTIC NO. 36337

**TAKEUCHI H**
METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I).
18317 APTIC NO. 36310

**TAKEUCHI J**
AIR POLLUTION DUE TO SO2 IN NAGOYA.
*18343 APTIC NO. 36848

**TAKEUCHI K**
METEOROLOGICAL SURVEY OF AIR POLLUTION IN OSAKA CITY (I).
18317 APTIC NO. 36310

**TAKEUCHI S**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

**TAMARU T**
GAS TURBINE COMBUSTORS.
17972 APTIC NO. 36268

**TAMORI Y**
RECENT TREND ON MEASUREMENT OF SOOT AND DUST, AND TECHNIQUE OF DUST COLLECTION.
*18207 APTIC NO. 36300
CUPOLA STACK GAS CONCENTRATION MEASUREMENT AND DUST COLLECTION.
*18208 APTIC NO. 36822

**TAMURA M**
THE RELATION OF NO, NO2, AND NO3 IN THE AIR.
18339 APTIC NO. 36855

**TANAKA H**
GAS CHROMATOGRAPHY OF COMBUSTION PRODUCTS.
17914 APTIC NO. 36898

**TANAKA S**
INSTRUMENTATION OF VEHICLE EXHAUST NOx ANALYZER BY SALTZMAN METHOD.
18140 APTIC NO. 36861

**TANAKA T**
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS NO.2 COLLECTION EFFICIENCY OF THIMBLE FILTER.
18148 APTIC NO. 36840
THE CHARACTERISTICS OF THIMBLE-FILTER FOR MEASURING METAL CONTENT IN STACK GAS. NO. 1 STUDY ON

THE IMPURITY METAL IN THIMBLE FILTER.
18184 APTIC NO. 36841

**TASIRO H**
TREATMENT OF HYDROGEN SULFIDE GAS AT TAGONOURA HARBOR.
18091 APTIC NO. 37200

**TAZAWA S**
SOME ASPECTS ON POLLUTED GASES EMITTED FROM KEROSENE BURNING STOVE.
17980 APTIC NO. 36500
EFFECT OF O2 CONTENT ON NO DETERMINATION IN FLUE GASES.
18162 APTIC NO. 36860
ATMOSPHERIC SULFUR OXIDES DETERMINATION BY ATOMIC ABSORPTION METHOD.
18168 APTIC NO. 37205

**TEER E H**
ATMOSPHERIC LEAD CONCENTATION ABOVE AN URBAN STREET.
*18265 APTIC NO. 36449

**TENENBAUM A E**
POTENTIOMETRIC DETERMINATIONS OF THE GROUP COMPOSITION OF SULFUR COMPOUNDS PRESENT IN STRAIGHT-RUN GASOLINE FRACTIONS.
17966 APTIC NO. 36533

**TEPPER L B**
SEVEN-CITY STUDY OF AIR AND POPULATION LEAD LEVELS. AN INTERIM REPORT.
*18266 APTIC NO. 36195

**TER HAAR G L**
COMPOSITION, SIZE AND CONTROL OF AUTOMOTIVE EXHAUST PARTICLATES.
*17975 APTIC NO. 37176

**TERMEULEN M A**
AIR POLLUTION CONTROL BY OIL REFINERIES.
*18101 APTIC NO. 36430

**THIEBAULT R**
ATMOSPHERIC POLLUTION IN PARIS BY VEHICLE EXHAUST GASES - MEASUREMENT OF POLLUTION LEVELS AND FIRST SUGGESTED REMEDIES.
18233 APTIC NO. 36385

**THOMAS A**
INFLUENCE OF HOMOGENEOUS CHARGE ON THE EXHAUST EMISSIONS OF HYDROCARBONS, CARBON MONOXIDE, AND NITRIC OXIDE FROM A MULTICYLINDER ENGINE.
18057 APTIC NO. 36081

**THOMAS C C**
ECOLOGICAL AND TECHNOLOGICAL ASPECTS OF UTILIZATION OF WASTE DISPOSAL HEAT.
*18102 APTIC NO. 36353

**THOMAS C W**
COSMOGENIC RADIONUCLIDE TRACERS OF IN-CLOUD SCAVENGING PROCESSES.
18325 APTIC NO. 36442

**THOMAS H V**
SPUTUM HISTAMINE AND INHALATION TOXICITY. (FINAL REPORT).
*18445 APTIC NO. 36199

**THOMAS W A**
OAK RIDGE AIR QUALITY INDEX.
*18209 APTIC NO. 36179

**THOMPSON R J**
A RAPID SENSITIVE METHOD FOR THE CALIBRATION OF PERMEATION DEVICES.
18169 APTIC NO. 36133

**THOMSON J G**
ASBESTOS AS AN URBAN AIR CONTAMINANT.
*18446 APTIC NO. 36360

**TING I P**
LEAF ONTOGENY AS A FACTOR IN SUSCEPTIBILITY TO OZONE: AMINO ACID AND CARBOHYDRATE CHANGES DURING EXPANSION.
*18472 APTIC NO. 37170

**TODAKA H**
AIR POLLUTION OF URBAN SCALE AND METEOROLOGICAL FACTOR.
18302 APTIC NO. 36492

**TOHATA H**
CATALYTIC COMBUSTION OF HYDROCARBON VAPORS.
18049 APTIC NO. 36472

**TOMALA D**
DIURNAL CHANGES OF THE SULFUR DIOXIDE CONCENTRATIONS IN THE UNIVERSITY DISTRICT OF GLIWICE DURING THE SPRINGTIME.
18256 APTIC NO. 36281

**TOMIDA B**
THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
*18267 APTIC NO. 36288

**TOMINAGA Y**
AIR POLLUTION OF HITACHI DISTRICT (REPORT 2).
18287 APTIC NO. 36810

**TOMITA B**
ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
18303 APTIC NO. 37198

**TOMITA T**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

**TOPPING D R**
ELECTROSTATIC CHARGING AND DISSIPATION OF DUST CLOUDS IN ENCLOSED ROOMS.
18045 APTIC NO. 36117

**TOSHIMA K**
INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**TOYA Y**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

**TOYOSHIMA K**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
*18268 APTIC NO. 36843
ON THE AIR POLLUTION OF ATSUMI PENINSULA, AICHI PREFECTURE.
18303 APTIC NO. 37198

**TRAINA F**
KINETICS OF SULFUR DIOXIDE OXIDATION WITH MONTECATINI EDISON CATALYST AND MATHEMATICAL MODEL OF AN INDUSTRIAL REACTOR.
18357 APTIC NO. 36219

**TRICKLEBANK S B**
ELECTRIC STORAGE BATTERIES FOR VEHICLE PROPULSION.
17932 APTIC NO. 36451

**TSUCHIDA K**
THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

**TSUCHIHIRA K**
THE PRESENT CONDITION OF SULFUR OXIDES IN NAGOYA CITY AREA.
18268 APTIC NO. 36843

**TSUJI K**
STUDIES OF SUSPENDED PARTICULATES IN AIR (4).
*18210 APTIC NO. 36838

**TSUJI M**
ON THE CONCENTRATION OF AMINE AND ALDENYDE COMPOUNDS FROM FISH-MEAL PLANTS.
*18269 APTIC NO. 36850

**TSUJIKAWA T**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**TSUJIMOTO T**
ODOR POLLUTION OF KASHIMA DISTRICT.
18258 APTIC NO. 36845

**TSUKAMOTO Y**
TREATMENT OF HYDROGEN SULFIDE GAS AT TAGONOURA HARBOR.
18091 APTIC NO. 37200

**TSUNETOSHI Y**
INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**TUNCAY O C**
LEAD LEVELS IN DECIDUOUS TEETH OF URBAN AND SUBURBAN AMERICAN CHILDREN.
18436 APTIC NO. 36534

**TWISS S**
SPUTUM HISTAMINE AND INHALATION TOXICITY. (FINAL REPORT).
18445 APTIC NO. 36199

**TWO HUNDRED FIFTY MILLION**
TWO HUNDRED FIFTY MILLION LBS OF SOOT AND SOMETHING TO DO ABOUT IT.
*18103 APTIC NO. 36863

## U

**UCHIDA S**
UNLEADED GASOLINE PROBLEMS.
*18526 APTIC NO. 36030

**UCHIYAMA Y**
EGR AS COUNTERMEASURE TO NOX IN DIESEL ENGINE.
*18104 APTIC NO. 37182

**UEDA M**
INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**UEKI T**
FORECAST OF SULFUR OXIDES INTENSITY IN TOKYO.
*18344 APTIC NO. 36811

**UENO S**
AIR POLLUTION CONTROL AND ITS EVALUATION OF THE SEVERAL CITIES IN YAMAGUCHI PREFECTURE.
18437 APTIC NO. 36809

**UKIJIMA Y**
STUDY OF THE INFLUENCE OF HYDROGEN SULFIDE (I). A SIMPLE METHOD FOR THE HYDROGEN SULFIDE PAPER BADGE.
ERROR

**UMEHARA K**
AIR POLLUTION CAUSED BY EXHAUST GAS OF AUTOMOBILES IN SHIZUOKA PREFECTURE.
*18270 APTIC NO. 36909

**UMEMURA Y**
FACTORS INFLUENCING THE CYCLIC VARIATION OF COMBUSTION OF SPARK IGNITION ENGINE.
17949 APTIC NO. 36113

**UMESAWA K**
TREATMENT OF HYDROGEN SULFIDE GAS AT TAGONOURA HARBOR.
18091 APTIC NO. 37200

**UMEZAWA M**
AIR POLLUTION CAUSED BY EXHAUST GAS OF AUTOMOBILES IN SHIZUOKA PREFECTURE.
18270 APTIC NO. 36909

**UNDINTSEVA V S**
KINETICS OF THE REACTION BETWEEN SO2 AND H2S.
*18379 APTIC NO. 36086

**UNO H**
DETERMINATION OF SULFURIC ACID AEROSOL IN SUSPENDED PARTICULATE.
18188 APTIC NO. 36904

## V

**VADOT L**
STUDY OF DIFFUSION BY MEANS OF AN HYDRAULIC ANALOGY.
*18345 APTIC NO. 36439

**VALY F**
DESULFURIZATION OF INDUSTRIAL GASES.
*18105 APTIC NO. 36240

**VAN CAUWENBERGHE K**
CHEMISTRY AND DETERMINATION OF AIR POLLUTANTS.
17924 APTIC NO. 36045

**VAN DE VOORDE N**
DRY PURIFICATION OF INCINERATOR OFF-GASES.
18012 APTIC NO. 36174

**VAN ENGELEN B**
INVESTIGATION INTO CORROSION IN THE ELECTRO-FILTERS OF GARBAGE INCINERATION PLANT.
18475 APTIC NO. 36828

**VAN GANSE W F**
CHRONIC NONSPECIFIC RESPIRATORY DISEASE. BERLIN, N.H., 1961-1967 - A PROSPECTIVE STUDY.
18410 APTIC NO. 36217

**VANDEGRIFT A E**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
*17976 APTIC NO. 36343

**VARYUKHIN V A**
CATALYTIC REDUCTION OF TERTRAPHENYL LEAD WITH BIS-ALLYL PALLADIUM CHLORIDE.
18359 APTIC NO. 36524

**VASEVA G A**
METABOLISM OF CARBON-14 COMPOUNDS IN FORAGE GRASSES AND THE EFFECT OF SULFUR DIOXIDE ON IT.
18466 APTIC NO. 36165

**VASYUTIN L F**
FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL.
18477 APTIC NO. 36804

**VELDS C A**
AIR POLLUTION BY PLUMES, PART 6. REQUIRED STACK DIMENSIONS.
*18535 APTIC NO. 36816
AIR POLLUTION FROM PLUMES, PART 5. DISPERSION CALCULATIONS.
*18346 APTIC NO. 36817
AIR POLLUTION FROM PLUMES, PART 3. PERMISSIBLE CONCENTRATIONS.
*18489 APTIC NO. 36818
AIR POLLUTION FROM SMUTS, PART 2. METEOROLOGICAL ASPECTS.
*18347 APTIC NO. 36819

**VELICKOVA V**
ON THE QUESTION ABOUT THE PRACTICAL APPLICATION OF THE INDICATOR TUBES.
18164 APTIC NO. 36182

**VILLALOBOS R**
ANALYSIS OF CATALYTIC CRACKER REGENERATOR FLUE GAS.
18151 APTIC NO. 36226

**VINCENT D A**
DESTROYING ODOROUS GASES EVOLVING FROM WET BIOLOGICAL MATERIAL.
18106 APTIC NO. 36892

**VINCENT D B**
DESTROYING ODOROUS GASES EVOLVING FROM WET BIOLOGICAL MATERIAL.
*18106 APTIC NO. 36892

**VISHNEVSKIY V L**
EFFECT OF HYDROGEN FLUORIDE ON INTEGRAL INDICES OF THE CONDITION OF ANIMALS.
*18447 APTIC NO. 36411

**VLODAVETS V V**
MOLD FUNGI IN THE AIR OF MOSCOW.
*18271 APTIC NO. 36412

**VOROBYEV D D**
FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL.
18477 APTIC NO. 36804

**VOS R H D**
MERCURY IN THE ENVIRONMENT - TECHNIQUES OF ANALYSIS.
18165 APTIC NO. 36826

## W

**WAGNER P E**
THREE-DIMENSIONAL QUADRUPOLAR MASS ANALYZER. I. GENERAL DESCRIPTION.
18143 APTIC NO. 36119

**WAJSFELNER R**
ON THE DETERMINATION OF AEROSOL PARTICLE SIZE DISTRIBUTION BY THE DIFFUSION BATTERY METHOD.
*18211 APTIC NO. 36202

**WAKAMATSU S**
VERTICAL DISTRIBUTION OF HEAVY METALS CARBON MONOXIDE ETC. IN THE URBAN AIR.
18318 APTIC NO. 36487
METEOROLOGICAL STUDIES ON THE AIR POLLUTION AT KEIHIN INDUSTRIAL REGION IN WINTER.
*18348 APTIC NO. 36807

**WAKASUGI K**
INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**WALDMAN J L**
THE REMOVAL OF CARBONYL SULPHIDE FROM INDUSTRIAL GASES.
18001 APTIC NO. 37203

**WARNER J L JR**
FUME ABATER CONVERTS WASTE TO USEFUL ENERGY.
18041 APTIC NO. 36280

**WASSERMAN H H**
SINGLET OXYGEN REACTIONS FROM PHOTOPEROXIDES.
*18380 APTIC NO. 36325

**WATANABE I**
DETERMINATION OF PAN.
18185 APTIC NO. 36832

**WATANABE S**
AN OZONE JOURNAL.
18413 APTIC NO. 36370
MECHANISM OF REDUCTION OF SO2 IN EXHAUST GAS IN CASE OF COMBUSTION WITH FUEL ADDITIVE.
*18107 APTIC NO. 36911
THE METAL CONTENT IN THE AIR OF CITIES IN AICHI PREFECTURE.
18267 APTIC NO. 36288

**WATANABE Y**
STATISTICAL INFERENCE IN FREQUENCY DISTRIBUTION MODEL FOR AIR POLLUTION AREA. (THE 2ND).
18352 APTIC NO. 36521

**WATKINS C H**
HYDRODESULFURIZATION OF ATMOSPHERIC AND VACUUM GAS OILS.
*18108 APTIC NO. 36417

**WEAVER E E**
PROCESS FOR EXHAUST GAS CLEANING.
18047 APTIC NO. 36302

**WEAVER N K**
TOXICOLOGIC IMPLICATIONS OF MOTOR GASOLINE AND AUTO EMISSIONS.
*18448 APTIC NO. 37180

**WELLS D M**
GAS PRODUCTION FROM BEEF CATTLE WASTES.
17950 APTIC NO. 36404

**WEST P W**
SPECIFIC METHOD FOR THE DETERMINATION OF ZONE IN THE ATMOSPHERE.
18192 APTIC NO. 36887
MICRODETERMINATION OF CADMIUM AIRBORNE PARTICULATES BY MEANS OF THE RING-OVEN TECHNIQUE.
18137 APTIC NO. 36034

**WETMILLER R S**
EFFECT OF DIESEL FUEL ON EXHAUST SMOKE AND ODOR.
*17977 APTIC NO. 36060

**WETTIG K**
THE REDUCTION OF CARCINOGENIC CONTAMINANTS IN EXHAUST GASES OF PETROL ENGINES THROUGH FUEL ADDITIVES AND CHOICE OF LUBRICANTS.
18042 APTIC NO. 36437

**WHANG J S**
DYNAMICAL PROPERTIES OF AEROSOL BEAMS.
18157 APTIC NO. 36341

**WHITTENBERGER J L**
A COMPARISON OF THE ACUTE EFFECTS OF SO2 ADMINISTERED ALONE OR IN COMBINATION WITH NACL PARTICLES ON THE RESPIRATORY MECHANICS OF HEALTHY ADULTS.
18412 APTIC NO. 36363

**WHITTINGHAM G**
ADVANCED HEAT PROCESSES.
*17978 APTIC NO. 36094

**WIESNER E**
IMPROVEMENTS ON OR RELATING TO COMPOSITE FILTERS.
18095 APTIC NO. 36056

**WIKLANDER L**
LEAD IN SOIL AND PLANTS. I. INFLUENCE OF MOTOR VEHICLES.
*17979 APTIC NO. 36032

**WILLARD D H**
STUDIES OF INHALED RADON DAUGHTERS, URANIUM ORE DUST, DIESEL EXHAUST, AND CIGARETTE SMOKE IN DOGS AND HAMSTERS.
18443 APTIC NO. 36454

**WILLIS D E**
GAS CHROMATOGRAPHIC ANALYSIS OF OFF-GAS HYDROCARBON PYROLYSIS.
*18212 APTIC NO. 37161

**WILLIS H A**
GAS SAMPLE ANALYSIS CELLS.
*18213 APTIC NO. 36915

**WISSE J A**
METEOROLOGICAL ASPECTS OF THE FORMING OF PHOTOCHEMICAL SMOG.
*18349 APTIC NO. 36042

**WITTE E**
HOW FAR ADVANCED ARE NEW ENERGY SOURCES FOR ELECTRICAL TRUCKS? Foerdern Heben, 19(5):295-297, 1969. 7 refs. Translated from German, 7p.
*18109 APTIC NO. 36460
THE MAXIMUM EXPIRATORY FLOW-VOLUME CURVE: PEAK FLOW AND EFFORT INDEPENDENT PORTION.
*18449 APTIC NO. 36102

**WOOD F A**
DISCUSSION OF PAPER BY DR. DAINES.
*18490 APTIC NO. 36149

**WOODWORTH J A**
INFLUENCE OF HOMOGENEOUS CHARGE ON THE EXHAUST EMISSIONS OF HYDROCARBONS, CARBON MONOXIDE, AND NITRIC OXIDE FROM A MULTICYLINDER ENGINE.
18057 APTIC NO. 36081

**WOOLER P T**
A WIND TUNNEL INVESTIGATION OF JETS EXHAUSTING INTO A CROSSFLOW. VOLUME IV. ADDITIONAL DATA FOR THE THREE-JET CONFIGURATION.
18360 APTIC NO. 36137

**WRZENSNIOWSKA K**
HISTOLOGICAL INVESTIGATIONS OF THE EFFECT OF NITROGEN OXIDES AND OZONE ON SOME ORGANS OF LABORATORY ANIMALS.
18392 APTIC NO. 36284

**WYATT J P**
THE EMPHYSEMA PROFILE IN TWO MIDWESTERN CITIES IN NORTH AMERICA.
18425 APTIC NO. 36400

**WYNDER E L**
SHORT-TERM DETERMINATION OF CARCINOGENIC AROMATIC HYDROCARBONS.
18145 APTIC NO. 36358

**Y**

**YAGI R**
SOME ASPECTS ON POLLUTED GASES EMITTED FROM KEROSENE BURNING STOVE.
*17980 APTIC NO. 36500

**YAJIMA I**
CONTROL OF THE VAPORIZED HYDROCARBON EMISSION.
*18110 APTIC NO. 37197

**YALAMOV Y I**
THEORY OF THERMOPHORESIS OF VOLATILE AEROSOL PARTICLES AND DROPLETS OF SOLUTIONS.
*18381 APTIC NO. 36914

**YAMAGUCHI T**
FACTORS INFLUENCING THE CYCLIC VARIATION OF COMBUSTION OF SPARK IGNITION ENGINE.
17949 APTIC NO. 36113

**YAMAMOTO H**
ON THE TWO-DIMENSIONAL DISTRIBUTION DIAGRAMS OF WIND-VELOCITY AND AIR POLLUTION.
*18350 APTIC NO. 36493

**YAMAMOTO M**
METHOD AND CATALYST FOR THE PURIFICATION OF WASTE GAS CONTAINING CARBON MONOXIDE.
18052 APTIC NO. 36298
RELATION BETWEEN AIR POLLUTION AND DIURNAL RANGE OF AIR TEMPERATURE IN ICHIARA DISTRICT.
*18351 APTIC NO. 36289

**YAMAMOTO S**
AFTERBURNER TYPE EXHAUST PURIFICATION APPARATUS.
18037 APTIC NO. 36880

**YAMANE Y**
STUDIES ON METALS IN AIR POLLUTION. III. IRON, ZINC, CHROMIUM, COBALT, ANTIMONY AND SCANDIUM AMOUNTS OF DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR GEOMETRICAL VARIATIONS.
*18272 APTIC NO. 36293

**YAMASAKI H**
RESEARCH ON REGIONAL REPRESENTABILITY OF SO2 CONCENTRATION.
18228 APTIC NO. 36805

**YAMASHITA K**
ACCESSIBLE DUST PARTICLES FOR TESTS.
*18214 APTIC NO. 36515
MEASUREMENT OF AIRBORNE PARTICULATE IN DUST CONTROLLED AREA.
*18111 APTIC NO. 36528
INSTRUMENTATION OF NOx ANALYZER BY CHEMILUMINESCENCE METHOD.
18139 APTIC NO. 36856

**YAMASHITA K I**
CONTAMINATION CONTROL.
*18215 APTIC NO. 37178

**YAMATE N**
AIR POLLUTION AS MEASURED BY AUTOMATIC ANALYZER (VII).
18249 APTIC NO. 36808
STUDIES ON PHOTOCHEMICAL PRODUCTS OF AROMATIC HYDROCARBON-NITROGEN DIOXIDE MIXTURES IN AIR.
*18382 APTIC NO. 36835

**YAMAZAKI H**
ON HEAVY METALS IN SUSPENDED PARTICULATE AND LOCAL CHARACTERISTICS IN TOKYO.
18251 APTIC NO. 37191
DETERMINATION OF PAN IN ATMOSPHERE.
18202 APTIC NO. 37206

**YANAGIHARA S**
STUDY ON MEASUREMENT OF AUTOMOTIVE EXHAUSTS.
18156 APTIC NO. 37183
AIR POLLUTION AND AUTOMOTIVE ENGINES (2).
*18112 APTIC NO. 36204

**YASUNO S**
INVESTIGATION OF AIR POLLUTION IN SOUTHERN AREA OF NAGOYA.
*18273 APTIC NO. 37186

**YASUOKA M**
INVESTIGATION OF ACUTE INFLUENCES.
18424 APTIC NO. 36830

**YATSENKO V M**
EFFECTS OF MINERAL NUTRITION ON CERTAIN PHYSIOLOGICAL-BIOCHEMICAL CHARACTERISTICS AND GAS RESISTANCE OF FORAGE GRASSES.
*18473 APTIC NO. 36161

**YAZAWA H**
STATISTICAL INFERENCE IN FREQUENCY DISTRIBUTION MODEL FOR AIR POLLUTION AREA. (THE 2ND).
*18352 APTIC NO. 36521

**YODA H**
THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

**YOKOYAMA E**
AN OZONE JOURNAL.
18413 APTIC NO. 36370

**YONEYAMA E**
TRACE METALS IN SUSPENDED PARTICULATES.
18252 APTIC NO. 36486

**YOON M C**
AIR POLLUTION ABATEMENT AND CONTROL OF AUTO EXHAUST.
*18113 APTIC NO. 36396

**YOSHIDA K**
AIR POLUTION IN YOKKAICHI (I).
18250 APTIC NO. 37202

**YOSHIMOTO H**
ABOUT DUST COLLECTOR IN ELECTRIC ARC FURNACE SHOP.
*18114 APTIC NO. 36470

**YOSHIMURA K**
CONCENTRATION OF SULFURIC ACID AEROSOL IN URBAN AREA.
*18353 APTIC NO. 36520

**YOSHIMURA Y**
AIR POLLUTION CONTROL IN NISHIYODOGAWA-KU, OSAKA CITY. (DESIGNATED AREA BY THE SPECIAL LAW CONCERNING THE RELIEF FOR THE PATIENTS RELATED TO ENVIRONMENT POLLUTION). NO. 1. PREVENTIVE METHODS OF GAS AND DUSTS.
18499 APTIC NO. 36306

**YOSHINAGA S**
SOIL CONTAMINATION BY HEAVY METALS IN ATMOSPHERIC DEPOSIT IN KITAKYUSHU CITY.
*17981 APTIC NO. 36846

**YOSHINARI H**
THE PRESENT CONDITION OF INSPECTION OF PHOTOCHEMICAL SMOG IN CHIBA PREFECTURE.
18306 APTIC NO. 37211

**YOSHIYAMA H**
STUDY ON EVALUATION CHOICE SAMPLING OF AIRBORNE DUST.
*18216 APTIC NO. 36837

**YOUNG J A**
COSMOGENIC RADIONUCLIDE TRACERS OF IN-CLOUD SCAVENGING PROCESSES.
18325 APTIC NO. 36442

**YUEN T G H**
WALL-FREE (L-PHASE VARIANTS OR MYCOPLASMA) ORGANISMS IN THE GUINEA PIG BRONCHUS: ASSOCIATION WITH MICROVILLI OF CILIATED CELLS.
18440 APTIC NO. 36198
THE SPONTANEOUS OCCURRENCE OF WALL-FREE ORGANISMS IN THE GUINEA PIG LUNG; ASSOCIATION WITH MICROVILLI AND CILIA.
18441 APTIC NO. 36200

**YUSHKEVICH N F**
PRODUCTION OF SULFUR FROM SULFUR DIOXIDE.
*18115 APTIC NO. 36183

**YUSIPOV M M**
THE STUDY OF PURIFICATION OF FLUE GASES FROM NITROGEN OXIDES BY KARATAU PHOSPHATE.
18068 APTIC NO. 36257

## Z

**ZANELLA E**
UTILIZATION OF SODIUM ALUMINATES FOR THE ABSORPTION OF SULFUROUS DIOXIDE FROM FLUE GASES.
18083 APTIC NO. 36853

**ZAPLETAL A**
THE MAXIMUM EXPIRATORY FLOW-VOLUME CURVE: PEAK FLOW AND EFFORT INDEPENDENT PORTION.
18449 APTIC NO. 36102

**ZAWISTOWSKI S**
HISTOLOGICAL INVESTIGATIONS OF THE EFFECT OF NITROGEN OXIDES AND OZONE ON SOME ORGANS OF LABORATORY ANIMALS.
18392 APTIC NO. 36284

**ZAYCHENKO V M**
FACTORS CAUSING ACCUMULATION OF CORROSIVE COMPONENTS IN ABSORPTIVE OIL.
*18477 APTIC NO. 36804

**ZEEDIJK H**
AGAIN THE RIJNMOND.
*18354 APTIC NO. 36043

**ZENZ C**
METAL FUME FEVER. A REPORT OF A CASE.
18411 APTIC NO. 36241

**ZERBE G A**
CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAMS. (FINAL REPORT).
18501 APTIC NO. 36342

**ZESCHMANN E G**
INFLUENCE OF HOMOGENEOUS CHARGE ON THE EXHAUST EMISSIONS OF HYDROCARBONS, CARBON MONOXIDE, AND NITRIC OXIDE FROM A MULTICYLINDER ENGINE.
18057 APTIC NO. 36081

**ZHURALEV V F**
METHOD AND APPARATUS FOR THE QUANTITATIVE MEASUREMENT OF CERTAIN COMPONENTS OF A GAS MIXTURE.
18125 APTIC NO. 36801

**ZIEGLER C A**
AUTOMOBILE EXHAUST ANALYSIS FOR LEAD USING A NUCLEAR TECHNIQUE.
18198 APTIC NO. 37175

**ZIEGLER H**
A WIND TUNNEL INVESTIGATION OF JETS EXHAUSTING INTO A CROSSFLOW. VOLUME IV. ADDITIONAL DATA FOR THE THREE-JET CONFIGURATION.
18360 APTIC NO. 36137

**ZORIN L L**
RECOVERY OF TITANIUM DIOXIDE FROM FLUE GASES WITH METAL CERAMIC FILTERS.
*18116 APTIC NO. 36518

**ZORKOCZY G**

PROCESS FOR THE EXTRACTION OF SULFUR FROM GASES CONTAINING HYDROGEN SULFIDE OR SULFUR DIOXIDE.
*18117 APTIC NO. 36171

**ZUTSHI P K**

SPECTROPHOTOMETRIC METHOD FOR THE STANDARDIZATION OF SULPHIDE RADICALS IN SOLUTION.
*18217 APTIC NO. 36167

ENVIRONMENTAL CONCENTRATIONS OF SOME OF THE MAJOR INORGANIC POLLUTANTS AT THE BARC SITE, TROMBAY, BOMBAY.
*18274 APTIC NO. 36168

AIR POLLUTION STUDIES IN TROMBAY REGION.
*18275 APTIC NO. 36237

# ORDER FORM

USE RESTRICTED AS INDICATED IN THE INTRODUCTION

SEND TO:

ENVIRONMENTAL PROTECTION AGENCY
AIR POLLUTION TECHNICAL INFORMATION CENTER
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

---

Date ____________________

Name ____________________

Program ____________________

Address ____________________

---

THIS FORM IS TO BE USED FOR ORDERING MICROFICHE DUPLICATES. INDICATE THE ARTICLES YOU REQUIRE BY CIRCLING THEIR APTIC NUMBERS. IF YOU DO NOT HAVE ACCESS TO A MICROFICHE READER, YOU MAY REQUEST PAPER COPIES. HOWEVER, MICROFICHE CAN USUALLY BE PROVIDED IN ABOUT 1/5 THE TIME REQUIRED TO PROVIDE PAPER COPIES.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36030 | 36031 | 36032 | 36034 | 36036 | 36038 | 36039 | 36040 | 36041 | 36042 | 36043 | 36044 | 36045 | 36046 |
| 36047 | 36049 | 36050 | 36051 | 36052 | 36053 | 36054 | 36055 | 36056 | 36057 | 36058 | 36059 | 36060 | 36061 |
| 36062 | 36063 | 36064 | 36066 | 36067 | 36069 | 36070 | 36072 | 36073 | 36074 | 36075 | 36076 | 36077 | 36079 |
| 36080 | 36081 | 36082 | 36083 | 36084 | 36085 | 36086 | 36087 | 36088 | 36089 | 36090 | 36091 | 36093 | 36094 |
| 36095 | 36096 | 36097 | 36098 | 36099 | 36100 | 36101 | 36102 | 36103 | 36104 | 36105 | 36107 | 36108 | 36110 |
| 36111 | 36112 | 36113 | 36116 | 36117 | 36118 | 36119 | 36120 | 36121 | 36123 | 36124 | 36126 | 36127 | 36128 |
| 36129 | 36131 | 36132 | 36133 | 36134 | 36135 | 36136 | 36137 | 36138 | 36139 | 36140 | 36141 | 36142 | 36143 |
| 36144 | 36145 | 36146 | 36147 | 36149 | 36150 | 36151 | 36152 | 36153 | 36154 | 36155 | 36157 | 36158 | 36159 |
| 36161 | 36162 | 36163 | 36164 | 36165 | 36166 | 36167 | 36168 | 36169 | 36170 | 36171 | 36173 | 36174 | 36175 |
| 36176 | 36177 | 36178 | 36179 | 36180 | 36181 | 36182 | 36183 | 36184 | 36185 | 36186 | 36188 | 36189 | 36190 |
| 36191 | 36192 | 36193 | 36194 | 36195 | 36196 | 36197 | 36198 | 36199 | 36200 | 36201 | 36202 | 36203 | 36204 |
| 36205 | 36206 | 36207 | 36208 | 36209 | 36210 | 36212 | 36213 | 36215 | 36216 | 36217 | 36218 | 36219 | 36220 |
| 36221 | 36222 | 36223 | 36224 | 36225 | 36226 | 36227 | 36228 | 36229 | 36230 | 36231 | 36232 | 36233 | 36234 |
| 36236 | 36237 | 36238 | 36239 | 36240 | 36241 | 36242 | 36245 | 36246 | 36247 | 36248 | 36251 | 36252 | 36255 |
| 36256 | 36257 | 36258 | 36259 | 36260 | 36262 | 36264 | 36265 | 36266 | 36267 | 36268 | 36269 | 36270 | 36271 |
| 36273 | 36274 | 36275 | 36276 | 36277 | 36278 | 36280 | 36281 | 36282 | 36283 | 36284 | 36285 | 36286 | 36287 |
| 36288 | 36289 | 36290 | 36291 | 36293 | 36294 | 36295 | 36296 | 36297 | 36298 | 36299 | 36300 | 36301 | 36302 |
| 36303 | 36304 | 36305 | 36306 | 36307 | 36308 | 36310 | 36311 | 36312 | 36313 | 36314 | 36315 | 36316 | 36318 |
| 36319 | 36320 | 36321 | 36322 | 36323 | 36324 | 36325 | 36326 | 36327 | 36328 | 36329 | 36331 | 36332 | 36333 |
| 36334 | 36335 | 36336 | 36337 | 36338 | 36339 | 36340 | 36341 | 36342 | 36343 | 36344 | 36345 | 36346 | 36347 |
| 36348 | 36350 | 36351 | 36352 | 36353 | 36354 | 36355 | 36356 | 36357 | 36358 | 36359 | 36360 | 36361 | 36362 |
| 36363 | 36364 | 36366 | 36367 | 36368 | 36369 | 36370 | 36371 | 36372 | 36373 | 36374 | 36378 | 36379 | 36380 |
| 36381 | 36382 | 36383 | 36384 | 36385 | 36386 | 36387 | 36388 | 36389 | 36390 | 36391 | 36392 | 36393 | 36394 |
| 36395 | 36396 | 36397 | 36398 | 36399 | 36400 | 36401 | 36402 | 36403 | 36404 | 36405 | 36406 | 36407 | 36408 |

36409 36410 36411 36412 36413 36414 36415 36416 36417 36419 36420 36421 36422 36423
36424 36425 36426 36427 36428 36429 36430 36431 36432 36433 36434 36435 36436 36437
36438 36439 36440 36441 36442 36443 36444 36445 36446 36448 36449 36450 36451 36453
36454 36455 36457 36458 36459 36460 36461 36462 36463 36464 36465 36467 36468 36469
36470 36471 36472 36474 36475 36477 36478 36479 36480 36481 36483 36486 36487 36488
36490 36492 36493 36494 36495 36496 36497 36498 36499 36500 36501 36502 36503 36504
36505 36506 36507 36509 36510 36511 36512 36513 36514 36515 36516 36517 36518 36519
36520 36521 36522 36523 36524 36525 36526 36527 36528 36529 36531 36533 36534 36535
36536 36537 36538 36539 36540 36541 36542 36543 36544 36545 36546 36801 36802 36803
36804 36805 36806 36807 36808 36809 36810 36811 36812 36813 36815 36816 36817 36818
36819 36820 36821 36822 36823 36824 36825 36826 36827 36828 36829 36830 36831 36832
36833 36834 36835 36836 36837 36838 36839 36840 36841 36842 36843 36844 36845 36846
36848 36849 36850 36851 36852 36853 36854 36855 36856 36857 36858 36859 36860 36861
36862 36863 36865 36866 36867 36868 36869 36870 36871 36872 36873 36874 36875 36876
36877 36878 36879 36880 36881 36882 36883 36884 36885 36887 36888 36889 36890 36892
36893 36894 36895 36896 36897 36898 36899 36900 36901 36902 36903 36904 36905 36906
36907 36908 36909 36910 36911 36912 36913 36914 36915 36917 36918 36919 36920 37156
37157 37158 37159 37160 37161 37162 37163 37164 37165 37166 37167 37168 37169 37170
37171 37172 37173 37174 37175 37176 37178 37179 37180 37181 37182 37183 37185 37186
37187 37188 37189 37190 37191 37192 37193 37194 37195 37196 37197 37198 37199 37200
37201 37202 37203 37204 37205 37206 37208 37209 37210 37211 37212 37213 37215

*U.S. GOVERNMENT PRINTING OFFICE: 1972 484-485/211 1-3